SPACELABS Healthcare

91369 Service Manual

070-1156-00 Rev. E

Spacelabs Medical considers itself responsible for the effects on safety, reliability and performance of the equipment only if:

- *assembly operations, re-adjustments, modifications or repairs are carried out by persons authorized by Spacelabs Medical, and*
- *the electrical installation of the relevant room complies with the requirements of the standard in force, and*
- *the equipment is used in accordance with the operations manual.*

Spacelabs Medical will make available, on request, such circuit diagrams, component part lists, descriptions, calibration instructions or other information which will assist appropriately qualified technical personnel to repair those parts of the equipment which are classified by Spacelabs Medical as field repairable.

Spacelabs Medical is committed to providing comprehensive customer support beginning with your initial inquiry through purchase, training, and service for the life of your Spacelabs Medical equipment.

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Caution:

Rx Only **US Federal law restricts the devices documented herein to sale by, or on the order of, a physician.**

⚠ **Before use, carefully read the instructions, including all warnings and cautions.**

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Introduction

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Overview

Spacelabs Medical's products are designed and manufactured under good manufacturing practices and in compliance with all applicable regulatory requirements. To ensure proper operation in accordance with these guidelines, this product must be maintained by trained technicians, using Spacelabs Medical authorized replacement parts.

Warnings, cautions, and notes are used throughout this manual. They are identified by the formats shown below. Be sure to read all warnings, cautions, and notes included in each section of this manual.

Warning:

Alerts the user to potentially serious outcomes (death, injury, or serious adverse events) to the patient or user.

Caution:

Alerts the user to actions to be taken to avoid non-serious injury to the patient or user, or to adverse effects to the device.

Note:

Failure to observe notifications may result in unexpected outcomes.

The 91369 monitor is a lightweight, portable monitor designed for use as a compact bedside monitor or as a battery-operated transport monitor. The monitor features a five-wire, resistive touchscreen and can be operated on either AC mains or battery power.

The single-high module slot on the right side of the monitor accepts all single-high modules, including the 90496 Ultraview® Command module and 91496 Ultraview SL™ Command module, to permit the monitoring of parameters such as electrocardiography (ECG), pulse oximetry (SpO_2), temperature, and invasive pressure.

Figure 1-1: 91369 monitor

Physical Dimensions

Assembled weight	10.0 pounds (4.6 kg)
Dimensions	8.3 (H) × 11.7 (W) × 6.2 (D) inches (21.1 × 29.7 × 15.8 cm)

Electrical Specifications

Designed for continuous operation. Requires outlet with ground (Protective Earth) conductor. Designated Class I by applicable electrical safety standards.

AC Line Requirements

AC input voltage range	100 to 240 VAC
AC input current	1.0 A
AC input frequency range	50 – 60 Hz

Environmental Requirements

Operating temperature	0° to 50° C
Humidity (operating)	10% to 95% relative humidity, non-condensing

Regulatory Approvals

CSA certified. Meets IEC60601-1, UL60601-1, and CSA C22.2 No. 601.1 for electrical safety. CE marked in accordance with the Medical Device Directive 93/42/EEC.

Monitor Options

The following options are available:

Table 1: 91369 Monitor Options

Option	Definition
D	Perioperative
J	Dual-channel internal recorder (Polish,Czech, Portuguese language support only)
N	Vital Signs Calculations
O	Drug Dose Calculations
Q	Data Shuttle®
R	Patient Data Logger (PDL)
U	Dual-channel internal recorder (no Polish language support)
Z	Wireless networking
04	Four waveform zones
06	Six waveform zones

Display

The video input of the display conforms with the Video Electronics Standards Association (VESA) display resolution of 1024 × 768 pixels. The monitor does not support an external touchscreen.

	Vertical	Horizontal
Rate	64 Hz	51.584 Hz
Front porch	58 μs	0.350 μs
Sync width	116 μs	1.985 μs
Back porch	562 μs	2.101 μs
Blank	737 μs	4.435 μs
Video clock rate	68.5 MHz	51.584 KHz

Setup

Contents

Unpacking the Monitor

The 91369 monitor, one or two batteries, external AC power supply, and any optional accessories are all packaged and shipped in a single box. Keep at least one shipping box and its packing materials for re-shipping, if the monitor should ever require factory service.

Caution:

Observe precautions for handling electrostatic-sensitive devices!

Note:

- *Never touch electrostatic-sensitive electronic components without following proper anti-static procedures, including the use of an ESD wrist band and mat. An electrostatic discharge from your fingers can permanently damage electronic components and cause latent failures.*
- *All static-sensitive electronic components are packaged in static-shielding bags. Retain the bag for repackaging the component should you need to store it or return it to Spacelabs Medical for any reason.*

The monitor is typically shipped as follows:

Top Assembly — Contains the main enclosure with installed CPU, power supply, and I/O PCBAs.

Accessories — Contains the external DC power supply, U.S. power cord, international power cords (if applicable), and any cable assemblies ordered.

Before installing the monitor:

Note:

When removing items from the shipping containers, ensure that you remove ALL components from each container.

1 Unpack the received equipment.

2 Unpack the mounting hardware.

3 Conduct an equipment audit.

Upon receiving the equipment, complete a detailed inventory to verify that the equipment you received matches your order. This inventory must include serial numbers, model numbers, and all options and cables received. Carefully inspect these items for shipping damage. If any damage is evident, immediately notify the freight company and Spacelabs Medical.

Assembling the Monitor

Power and Battery Status

The three LEDs on the monitor indicate whether the monitor is connected to the AC mains power and the status of any installed batteries. Battery status conditions are indicated as described in the following sections.

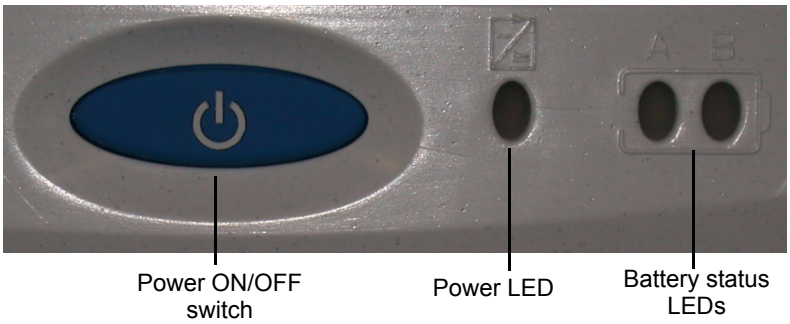


Figure 2-1: Battery status information

Power LED

The power LED is located immediately to the right of the power ON/OFF switch. This LED is lit whenever the monitor is connected to AC mains power via its power supply, and is not lit if the monitor is not connected to the AC mains power.

Battery Status LEDs

These LEDs are only active while the unit is connected to AC mains power.

Unlit LED

A battery LED that is neither solid ON nor flashing indicates a battery is not present.

Solid Green LED

A solid green battery LED indicates that the battery is fully charged. Only a charging cycle or a faulty battery will cause the green LED to flash, and these conditions only occur when a battery is installed in the monitor.

Flashing Green LED — Battery Charging

A flashing green battery LED indicates an installed battery is being charged and the monitor is not completely ready to be used in transport mode. This LED flashes in a constant pattern with no delays with the monitor powered ON or OFF. The flashing is different than the battery fault detection flash.

Note:

The green LED stops flashing and stays ON when the charging cycle is complete.

Intermittent Flashing Green LED — Battery Fault Detected

An intermittent flashing green LED indicates that this battery will not hold a charge, or is taking too long to charge. The intermittent signal is a repeating pattern of a solid green LED for one second and a flashing LED for one second. An error message is also added to the error log for review by your system administrator.

To determine whether a battery is faulty, power the monitor ON using the front-panel switch and observe the message displayed along the bottom of the monitor screen. Replace a faulty battery with the same battery type.

Installing/Replacing Batteries

NiMH batteries are used in the monitor. Refer to *Figure 2-2* to install one or two batteries.

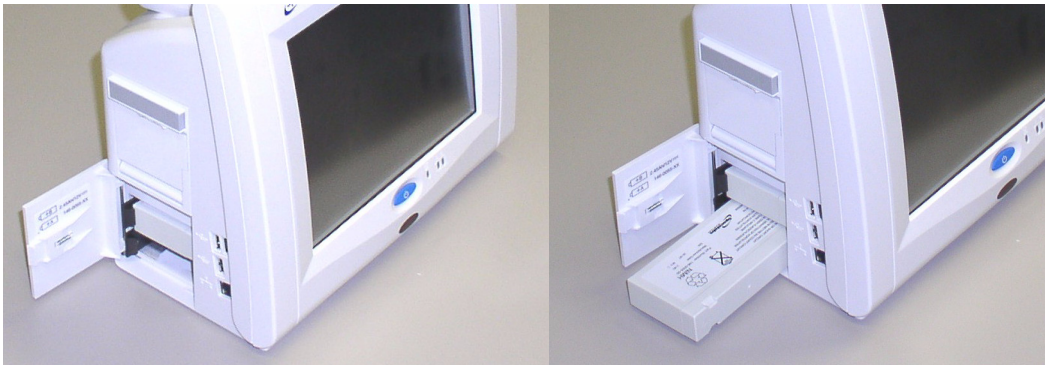


Figure 2-2: Monitor battery installation

While the monitor is operational, a single battery can be exchanged under any of the following conditions without a loss of patient data:

- The monitor is being powered by the external power supply.
- The monitor is operating on two batteries, and one charged battery remains connected at all times during the exchange.

Warning:

Batteries exposed to short circuit, high temperature, or fire may leak, vent, or explode.

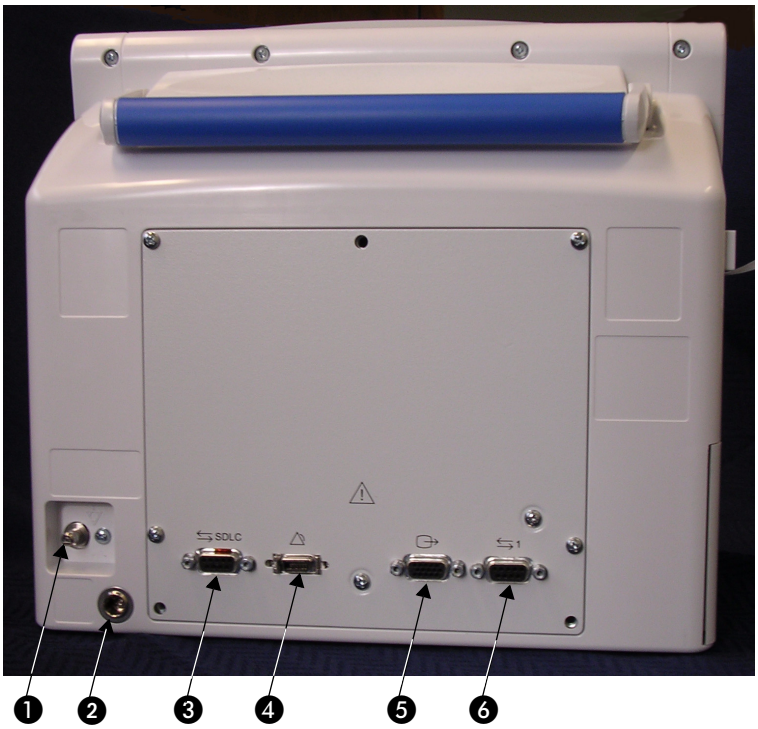
Caution:

Follow the manufacturer's recommended handling procedure. Collect and transport batteries in a manner that prevents short circuit, compacting, mutilation, or any other abuse that would compromise the physical integrity.

Connections

Refer to *Figure 2-3* for available connections on the monitor's rear panel. Refer to *Figure 2-4* for available connections on the monitor's side panel.

Rear Panel



1. Equipotential ground post
2. External power supply input
3. SDLC port
4. Alarm relay output
5. Video output
6. Serial port

Figure 2-3: Rear panel connections

Table 1: Rear Panel Cables

Rear Panel Connection	Description	Part Number
❻	Cable, Serial I/O (RS-232)	As required
❺	Cable, Video, DB15HD Male to DB15HD Male, 1.8 m (6 feet)	012-0593-00
❸	Cable, SDLC	As required
❸	Cable, Monitor to Module Housing, 0.61 m (2 feet)	012-0532-02
❸	Cable, Monitor to Module Housing, 1.22 m (4 feet)	012-0532-04
❸	Cable, Monitor to Module Housing, 2.44 m (8 feet)	012-0532-08
❸	Cable, Monitor to Module Housing, 3.05 m (10 feet)	012-0532-10

Caution:

For continued electromagnetic interference (EMI) radiation compliance, use only cables that have been tested and approved by Spacelabs Medical. Refer to *Table 2* ***on page 6-3*** **for all cable part numbers.**

Side Panel

❼ USB ports

❽ 10/100BaseT network connection

Figure 2-4: Side panel connections

Note:

The USB ports are to be used for Spacelabs-approved devices only (Symbol/Metrologic barcode scanner and Microsoft USB keyboard/mouse devices).

Table 2: Side Panel Cables

Side Panel Connection	Description	Part Number
❽	Cable, Ethernet, 10/100BaseT, 0.94 m (3 feet)	175-0951-00
❽	Cable, Ethernet, 10/100BaseT, 1.8 m (6 feet)	175-0951-01
❽	Cable, Ethernet, 10/100BaseT, 3.7 m (12 feet)	175-0951-02
❽	Cable, Ethernet, 10/100BaseT, 6.1 m (20 feet)	175-0951-03

Cabling

Maximum Cable Lengths

The following cables are limited to the indicated maximum length:

- **SDLC Cable** — 12.2 m (40 feet) maximum (total length from the monitor to the last device on the bus). For longer SDLC cable runs, contact a Spacelabs Medical Field Service Engineer.
- **Video Cable** — 30.5 m (100 feet) maximum (total length from the monitor to the last display).
- **Ethernet cable (10/100BaseT)** — 100 m (328 feet) maximum.

SDLC External Devices

External devices (for example, Flexport® system interfaces) can be connected to the SDLC bus. (In this context, the term “external” means connected to the SDLC bus by cable via an external connector. This is in contrast to modules, which are connected by inserting them into a module housing.)

If no supplementary module housings are present (in addition to the module slot integral to the monitor itself), then external devices are connected directly to the SDLC connector of the monitor.

If one or more supplementary module housings are present, Flexport devices are connected to connector J2 on one of the 90499 or 90491 supplementary module housings, or J3 on model 90485. Refer to the *Module Housings and Power Supplies Service Manual* (P/N 070-0680-xx).

If multiple module housings are present, external devices must be connected to the *last* module housing in the daisy-chain; that is, the housing electrically farthest from the monitor on the SDLC bus. Even though multiple connectors may be available, only the SDLC connector on the most distal module housing can be used for connecting external devices. Do not use more than a single Flexport connector, regardless of how many module housings are present.

If multiple Flexport interfaces are to be installed, they must be daisy-chained using the T-cable supplied with those devices. Up to three Flexport interfaces may be connected in this way.

Warning:

Unreliable system operation will occur if the SDLC bus is not correctly terminated or the maximum cable length is exceeded. Flexport interfaces must be attached to the most distal module housing on the SDLC bus.

SDLC Cable Interconnection

To ensure electromagnetic interference (EMI) compliance, the appropriate Spacelabs Medical 9-pin connector must be used. Refer to the *Module Housings and Power Supplies Service Manual* (P/N 070-0680-xx).

SDLC Bus Termination

The SDLC bus must be properly terminated for correct operation. If no external devices (for example, Flexports or multigas analyzers) are connected, proper termination of the SDLC bus is accomplished automatically. If external devices are connected, the switch on the module housing farthest from the monitor must be set to the terminated (⊗→) position. All others must be set to the non-terminated (→) position. The SDLC clock and data signals are switched by the terminator switches and are not present “downstream” of any switch set to the ⊗→ position.

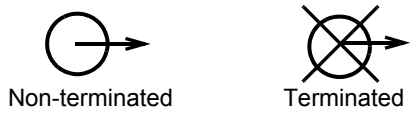


Figure 2-5: Terminator switch settings

Because bus termination is handled by setting the switches appropriately, an external terminator is only required when external devices are connected.

If external devices are connected, an external cable terminator is required to terminate the SDLC bus. This must be installed at the end of the SDLC bus (following the last external device). In this case, all module housings must have their switches in the → position.

Note:

Flexports require a powered Flexport cable (P/N 012-0555-00) when used with the 90491/90499 module housing or 91369 monitor. SDLC data is only passed along to the external device(s) when the terminator switch (SW2) is in the → position.

Alarm Relay

Alarm output signals are available at the Nurse Alert (🔔) connector instantaneously when an alarm occurs. *Table 3* describes the connector pinouts for remote alarms. *Figure 2-6*, *Figure 2-7*, and *Figure 2-8* illustrate the circuits for each alarm function.

External Alarm Pinout

Alarm connector pinouts are as follows:

Table 3: Connector Pinouts

Pin	Alarm Circuit	Meaning
1	Alarm 0 (high priority)	Common
2		Normally Closed
3		Normally Open
4		GND

Table 3: Connector Pinouts (continued)

Pin	Alarm Circuit	Meaning
5	Alarm 1 (medium priority)	Normally Closed
6		Normally Open
7		Common
8		GND
9		+12 V, 140 mA
10		GND
11		GND
12	Alarm 2 (low priority)	Normally Open
13		Common
14		Normally Closed

Warning:

For operational safety and reliability, the following relay contact ratings MUST NOT BE EXCEEDED:

- ***Current = 250 ma***
- ***Voltage = 28 V AC/DC***

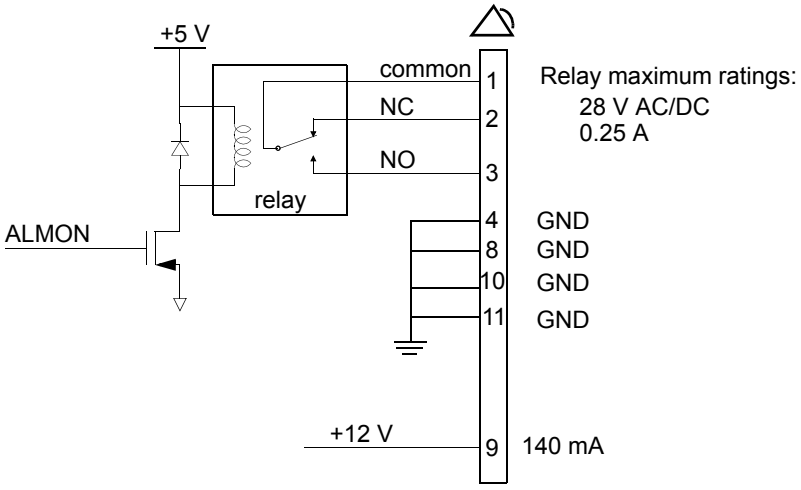


Figure 2-6: Alarm 0 (high priority) relay schematic

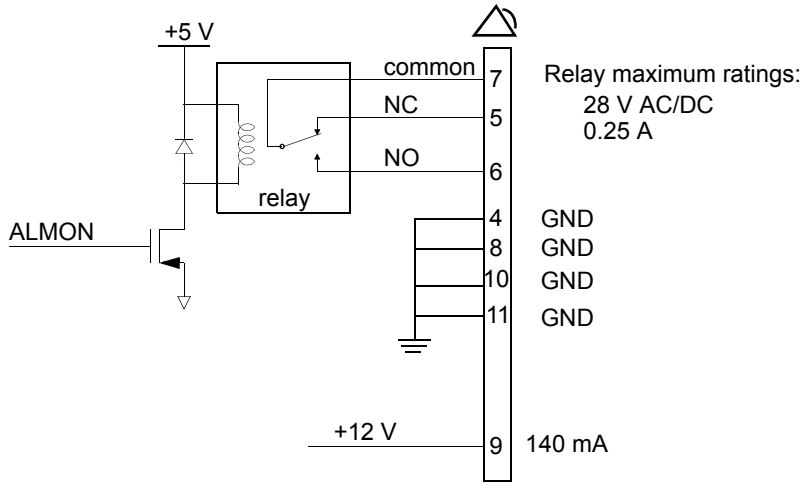


Figure 2-7: Alarm 1 (medium priority) relay schematic

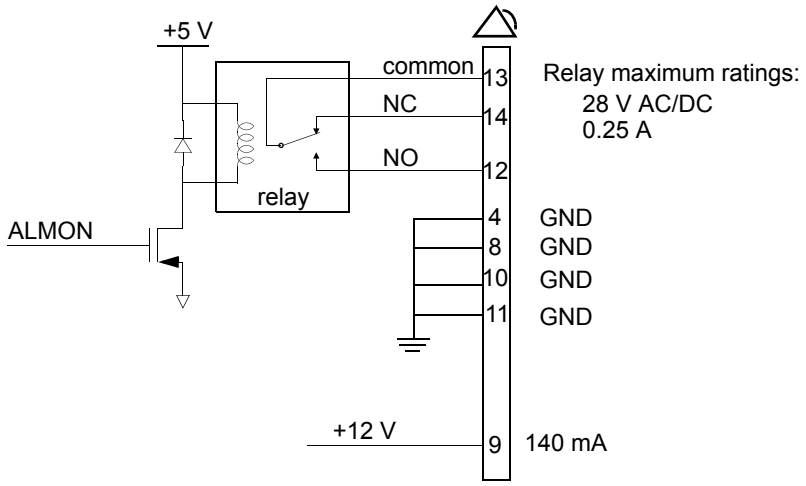


Figure 2-8: Alarm 2 (low priority) relay schematic

Network Installation

A typical network consists of bedside and central monitors and an optional clinical information system (*Figure 2-9*).

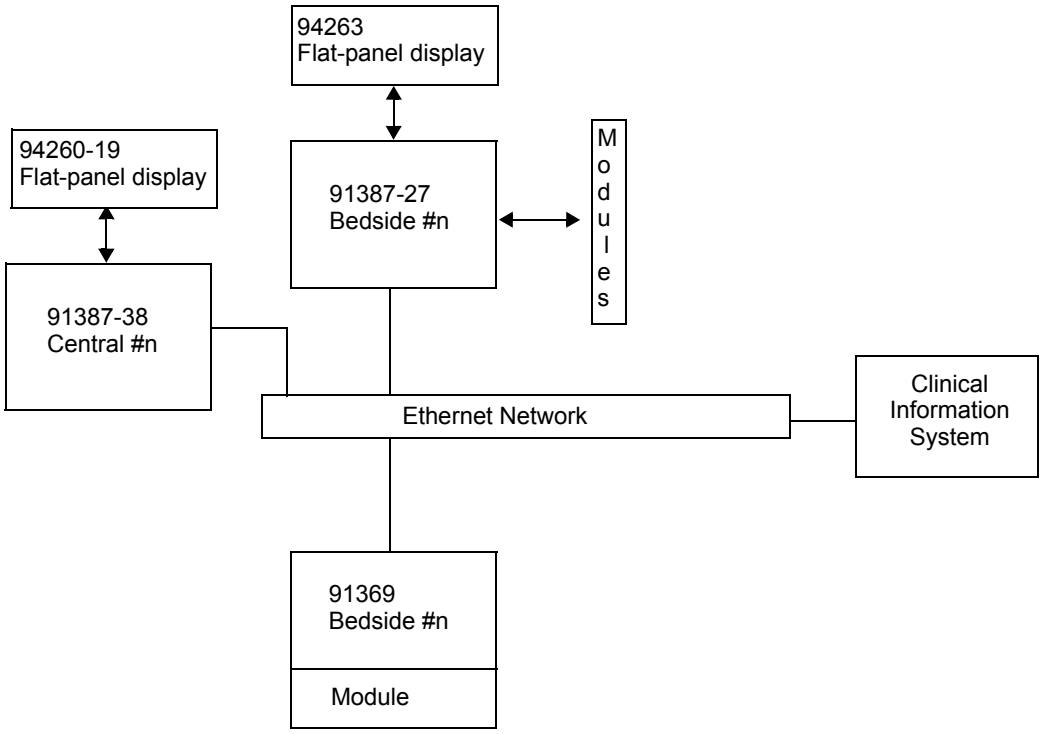


Figure 2-9: Typical network configuration

Warning:

Ensure that the Ethernet wall plate and the shield of the Ethernet connecting cable are bonded to the hospital grounding system.

Ethernet Network Connection

Caution:

- **Only qualified personnel should attempt to connect a monitor to an Ethernet LAN the first time.**
- **Do not connect the monitor to an Ethernet local area network (LAN) prior to configuring the following settings. The monitor must be properly configured for LAN access before you operate the monitor. If you fail to correctly configure the monitor, you may interrupt other units also using the LAN.**

Note:

Detailed installation instructions for the physical Ethernet LAN are beyond the scope of this document.

To connect a monitor onto an existing Spacelabs Medical Ethernet LAN, complete the following steps:

1 Install the monitor on a suitable table or shelf, ensuring that the air flow to the side air intake vents is unobstructed, or use a Spacelabs Medical mounting option.

2 Ensure that the monitor is not connected to the LAN.

3 Plug the power cord attached to the monitor's DC power supply into a standard hospital-grade AC power supply.

4 Power ON the monitor.

5 Enter a unique MONITOR ID, BED NAME, and SUBNET for the monitor. Refer to *Network Setup* on page 2-13 for more information.

6 Attach the 10/100BaseT LAN transceiver cable into the RJ45 connector on the left side of the monitor (❽ in *Figure 2-4* on page 2-6).

7 Connect the other end of the Ethernet cable from the monitor to the nearest port.

8 Configure the monitor's other network settings as necessary to ensure proper communication on the network. Refer to *Network Setup* on page 2-13.

Ethernet Network Disconnection

To remove a monitor from the LAN, disconnect the network cable from the 10/100BaseT network connection (❽ in *Figure 2-4* on page 2-6).

Power-ON Test

Each time the monitor is powered ON:

- Diagnostic information displays for approximately 10 seconds.
- The embedded alarm light cycles red and yellow. Some models may cycle red, yellow, and cyan.
- Monitor keys display on the right side of the screen.

The monitor is now ready for normal operation.

External Devices

If an external SDLC device, such as a Flexport interface, is to be installed, the 9-pin SDLC connector on the rear of the monitor or the module housing must be used. If multiple SDLC ports on module housings are available, only the SDLC port on the module housing farthest from the monitor can be used for external devices. Set the termination switch to non-terminated (⊖→) for all module housings and then terminate the external device.

Module Tests

To verify that the monitor functions correctly with parameter modules:

1 Insert an ECG module without the patient cables connected. Verify that the ECG parameter key is displayed.

2 Connect a patient simulator to the ECG input with a 5-lead patient cable, and set the simulator to a known rate.

- Verify that the heart rate and lead being monitored are displayed to the right of the ECG parameter key.
- Verify that the ECG waveform is displayed.

3 Disconnect the patient cable. After 10 seconds, verify that the *LEADS OFF* message appears, the parameter key flashes, and an alarm tone sounds.

4 Reconnect the patient cable and verify that the *LEADS OFF* message clears and the alarm stops.

5 Connect a patient simulator to the invasive pressure inputs.

6 Zero the pressures and verify that the numerics and waveforms are accurate.

7 Verify that the key tone sounds each time a key is selected.

Configuring the Monitor

The **Biomed Level** menu displays when the biomed password (default is **biomed**) is entered into the **Privileged Access** window. Refer to *Directory of Keys* on page 7-1 for the **Biomed Level** menu structure.

Network Setup

Note:

The NETWORK SETUP key only displays on monitors that are configured for network operation.

Touch NETWORK SETUP to display the **Monitor Setup - Network Configuration** window. This window contains an on-screen keyboard and three tabs: **TCP/IP**, **Monitor**, and **Printers**. Proper network operation requires that each device on the network have a unique network address, monitor ID, and monitor name. If the wireless option has been installed on the monitor, three more tabs will be present: **WLAN**, **Security**, and **Advanced**.

Editing Tab Fields

The fields within a tab on the **Monitor Setup - Network Configuration** window can be edited by selecting the field and entering new information using the on-screen or optional external keyboard.

When editing, adding, or deleting, press ENTER or TAB to cycle to the next input cell. Any changed or added items are stored in the monitor's non-volatile memory when SAVE is selected. The description of each tab indicates when that change takes effect (for example, immediately or after a monitor reset occurs).

To edit text within a tab:

1 Select an item from the list.

-OR-

2 Select an input cell's text and type any combination of letters, characters, or spaces.

To add an item to a list:

- Select the input cell and type the new information.

To delete an item from a list:

1 Select the item.

2 Touch **Del**.

3 Enter at least one space (an error message is displayed if no spaces are entered).

TCP/IP Tab

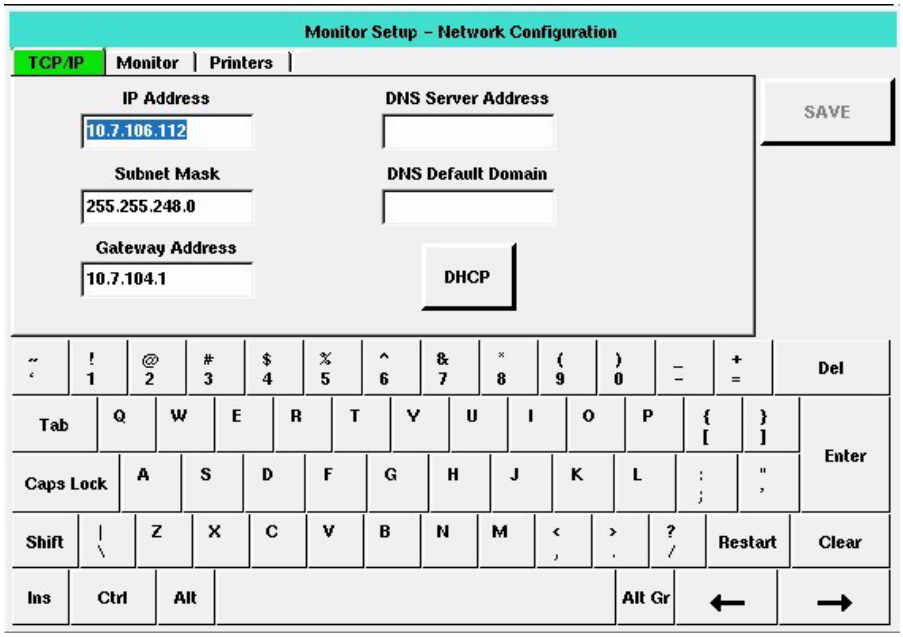


*Figure 2-10: **TCP/IP** tab*

The **TCP/IP** tab enables you to define the monitor's attributes for networking.

IP Address — Enables you to specify the monitor's IP address. The default is 164.90.254.10. Either a static IP address must be specified, or DHCP networking must be enabled.

Subnet Mask — Enables you to identify which parts of the IP address are to be used for TCP/IP subnet determination. The TCP/IP network's subnet mask is not related to the Spacelabs Medical network's subnet name. The standard and factory-default subnet mask is 255.255.255.0. Either a subnet mask must be specified, or DHCP networking must be enabled.

Gateway Address — Enables you to specify the IP address of the TCP/IP gateway (bridge or router) though which communication to other devices should flow. The default is blank.

DHCP — (Dynamic Host Configuration Protocol) Used to configure and enable DHCP network configuration. When DHCP is enabled, IP Address, Subnet Mask, and Gateway Address are automatically filled in. To use this service, a DHCP server must be available on the network to respond to DHCP requests.

Note:

- *A DHCP lease is a TCP/IP configuration given out from the DHCP server that is valid for a period defined by the DHCP server or forever (no expiration).*
- *Monitors configured for DHCP operation request a lease from the DHCP server when they boot up or when their existing lease expires during operation. If the DHCP server is not present, the monitor checks the expiration time of the last DHCP lease obtained. If the lease is still valid, the monitor continues to use those values and operates normally. If the lease has expired, the monitor disables TCP/IP networking and displays a NETWORK SIGNAL LOST message to indicate that it is unable to communicate over the network. The monitor continues to request a DHCP lease until it receives one.*
- *If the monitor's configured DECNET node ID is a duplicate on the network, the DHCP server can be confused. This may result in a duplicate or invalid DHCP lease and may prevent full network communication.*
- *The subnet mask must correctly correspond to the network size and type during operation. Monitors may not be able to fully communicate with each other if the DHCP server fails to set the network mask properly.*

The **DNS server address** is in standard TCP/IP address form, while the **DNS default domain** is a string of ASCII characters. A DHCP server may also provide this information.

Editing this tab is performed as described in *Editing Tab Fields* on page 2-13. Tabbing order is **IP Address** >> **Subnet Mask** >> **Gateway Address** >> **DHCP** >> **DNS Server Address** >> **DNS Default Domain** >> **IP Address**. Changes made to this tab's settings take effect after a successful save and monitor reset.

Secondary Display — The **Secondary Display** field is only available if option -D, Perioperative, has been activated.

Select **ENABLE** on the **TCP/IP** tab to activate the primary monitor's secondary display. When you enable the secondary display, the **IP Address** and **Secondary Hostname** fields become available and must contain a valid entry for the secondary monitor to operate. The **IP Address** and **Secondary Hostname** fields are exclusive to each other.

Enter a valid IP Address when your network is using static IP addresses.

-OR-

Enter a valid Secondary DNS hostname when your network is using DHCP for network configuration.

Changes made to the **Secondary Display** settings take effect after the changes have been saved.

Monitor Tab

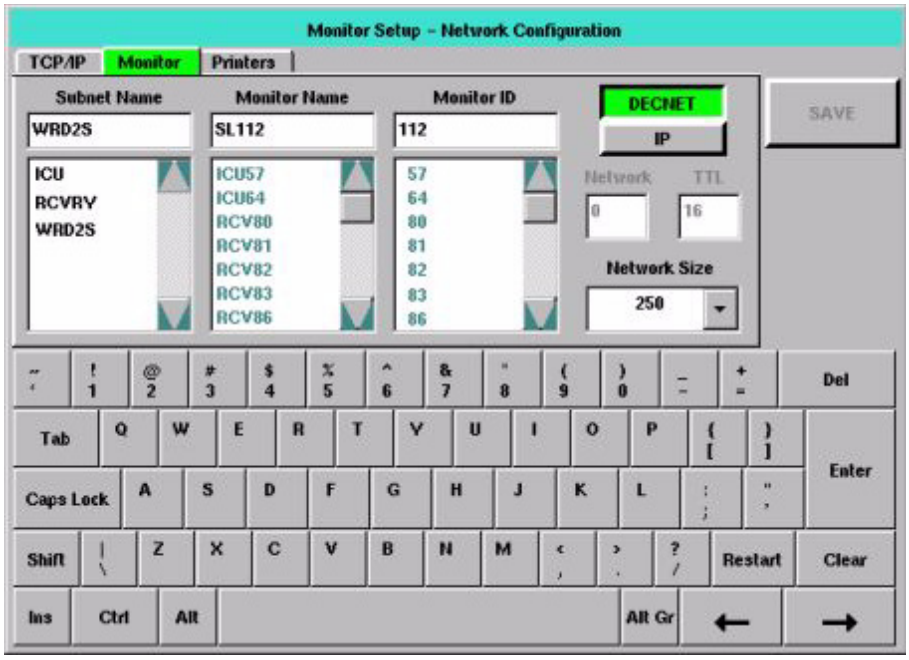


*Figure 2-11: **Monitor** tab*

The **Monitor** tab enables you to determine what monitor names, monitor (node) IDs, and subnet names are currently in use. The tab also enables you to enter settings for the monitoring network.

In *Figure 2-11*, the monitor's current settings are displayed in each input cell. The scroll list below each input cell displays the remaining items that have been detected on the network. Items in the **Subnet Name** and **Monitor Name** lists are displayed in alphanumeric order. Items in the **Monitor ID** list are displayed in numeric order.

Brackets (< >) surround strings that consist solely of spaces. The separation within the brackets indicates the number of spaces within that string.

Editing is performed as described in *Editing Tab Fields* on page 2-13. The tabbing order is **Subnet Name** >> **Monitor Name** >> **Monitor ID** >> **DECNET/IP** >> **Network** >> **TTL** >> **Subnet Name. Network** and **TTL** are skipped if unavailable. Changes made to this tab's settings take effect after a successful save and monitor reset.

Subnet Name

The subnet name contains up to five characters (default is five blanks). Items in this scroll list are selectable.

Monitor Name and Monitor ID

The Monitor Name is the name given to each bedside and central monitor (does not apply to telemetry bed names) to help the users identify monitors on the network. The Monitor Name contains five characters (default is **SL001**).

The Monitor ID is the numeric ID assigned to a monitor. Each device on the network must have a unique Monitor ID. This can be any number from 1 to 1023, depending on the Network Size selected.

To prevent duplication of currently used monitor names and IDs, items in these lists are not selectable. The error checking procedure performed when SAVE is selected also specifically checks for duplications.

Note:

- *Items in the Monitor Name and Monitor ID lists only display when the monitor is connected to the network.*
- *When entering a monitor name or ID, do not use a space between characters.*

DECNET/IP

You can configure the monitor to operate using either Spacelabs DECNET or TCP/IP network protocols. If you are communicating with 903xx Spacelabs Medical monitors, you must select DECNET.

Network

The IP multicast group number of the monitor provides a filter to logically isolate one monitor from another on TCP/IP installations. Up to 32 network numbers are available (0 to 31) with 0 as the default.

Note:

- *Monitors must use the same network number to communicate.*
- *This is unavailable if DECNET is selected.*

TTL (Time to Live)

The allowed number of hops the IP packet can take across network devices. TTL values are 1 to 64, with 16 as the default.

Note:

TTL is unavailable if DECNET is selected.

Network Size

The network size allows configuration as:

64 — Monitor IDs from 1 to 64 are supported. No more than 64 total monitor devices can be on the network. Provides complete network compatibility with legacy Spacelabs Medical monitors.

250 — Monitor IDs from 1 to 250 are supported.

Note:

903xx monitors must have the Expanded Network option installed or they will not communicate correctly with devices with Monitor IDs above 64.

640 — Monitor IDs from 1 to 127 and from 512 to 1023 are supported with the following restrictions.

- All model 903xx Spacelabs Medical monitors must use monitor IDs 1 to 127, inclusive.
- All model 91xxx monitors must be configured with monitor IDs from 512 to 1023, inclusive.

1000 — Monitor IDs from 1 to 1023 are supported (compatible only with Spacelabs Medical 91xxx series monitors).

Printers Tab

The **Printers** tab enables you to display controls for defining and storing printer names, choosing rules for printer selection, and selecting one or two network printers.

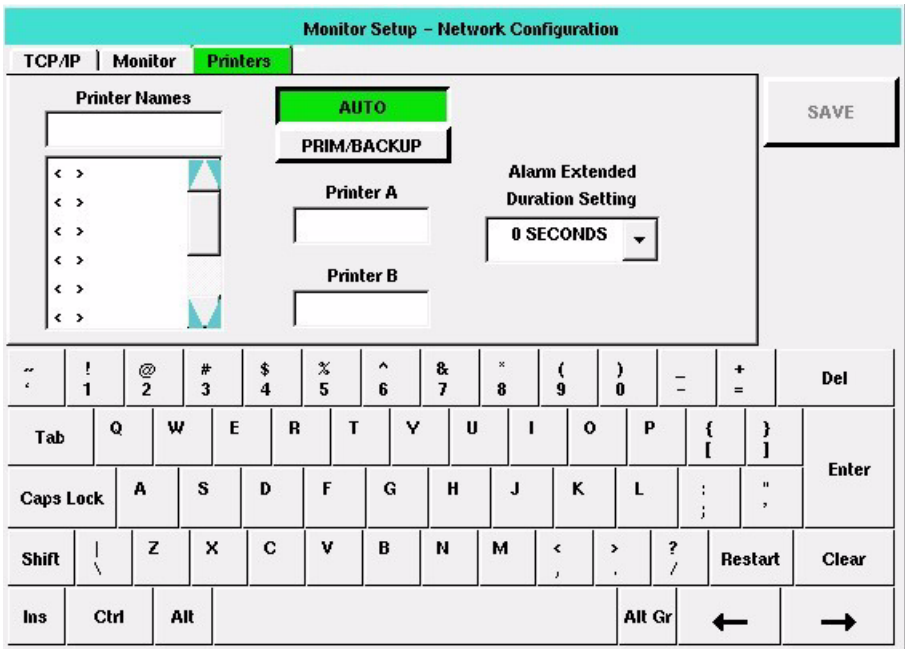


*Figure 2-12: **Printers** tab*

Editing is performed as described in *Editing Tab Fields* on page 2-13. The tabbing order is **AUTO / PRIM/ BACKUP** >> **Printer A** (or **Primary**) >> **Printer B** (or **Backup**) >> **Printer Names** (refer to *Figure 2-13* on page 2-19). Changes made to this tab's settings take effect after a successful save and monitor reset.

Printer Names

The **Printer Names** list displays up to eight, selectable printer names previously stored in the monitor, in the order in which they were stored. To display a new or changed name in the list, select that printer name from the list. Printer names contain up to five characters (default is five blanks).

Note:

- *Printer names are explicitly entered and may be duplicated. To clear a printer name from the list, select that name, touch **Clear**, touch **Enter**, and then touch **SAVE**.*
- *A local (SDLC) printer can be either a bedside printer or network printer, depending on the printer name selected in this list. A local printer is configured as a network printer if the local monitor's name is selected. Otherwise, a local printer functions as the bedside printer.*

AUTO / PRIM/BACKUP

The AUTO / PRIM/BACKUP key selects which set of printer selection rules the monitor uses for selecting network printers. It does not affect the monitor's selection of whether a networked or non-networked printer is used. Any changes made to the printer selection mode using this key take effect immediately, regardless of monitor type. The default setting is AUTO, which selects the destination printer using the weight-based printer selection rules. (Refer to the *Ultraview SL Operations Manual, P/N 070-1150-xx, located on CD-ROM P/N 084-1101-xx for additional information*).

When PRIM/BACKUP is selected, the monitor automatically selects the primary printer, unless that printer is unable to accept the recording. In that instance, the monitor then selects the backup printer. If the backup printer is also unable to accept the recording, the monitor displays an **Unable to record** message.

Printer Selection Fields

The default for the printer selection fields is blank (i.e., no printer selected). The labels above these fields vary, based on the current setting of the AUTO / PRIM/BACKUP key. If AUTO is selected, the labels are **Printer A** and **Printer B**. If PRIM/BACKUP is selected, the labels are **Primary** and **Backup** (*Figure 2-13*).

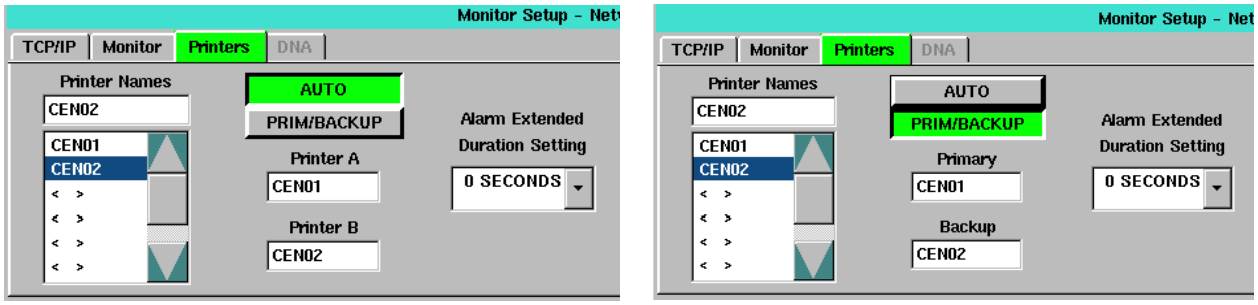


Figure 2-13: AUTO / PRIM/BACKUP selection differences

To define a printer name:

1 Select a printer name from the **Printer Names** list.

2 Select one of the two printer selection fields. The new value displays in the selected field.

WLAN Tab

This tab allows the operator to set basic wireless local area network (WLAN) related settings.

The **WLAN** tab only displays on monitors that are configured for wireless operation (option -Z). Monitors are configured for wireless operation by selecting the sysgen RADIO option. The **RADIO ON/OFF** keys and all other input cells and combo boxes illustrated in *Figure 2-14* are not available for selection if the radio is not present.

Caution:

Do NOT power the radio ON until all network configuration has been completed. Powering the radio ON with the monitor set to the factory defaults could interfere with the wireless network.

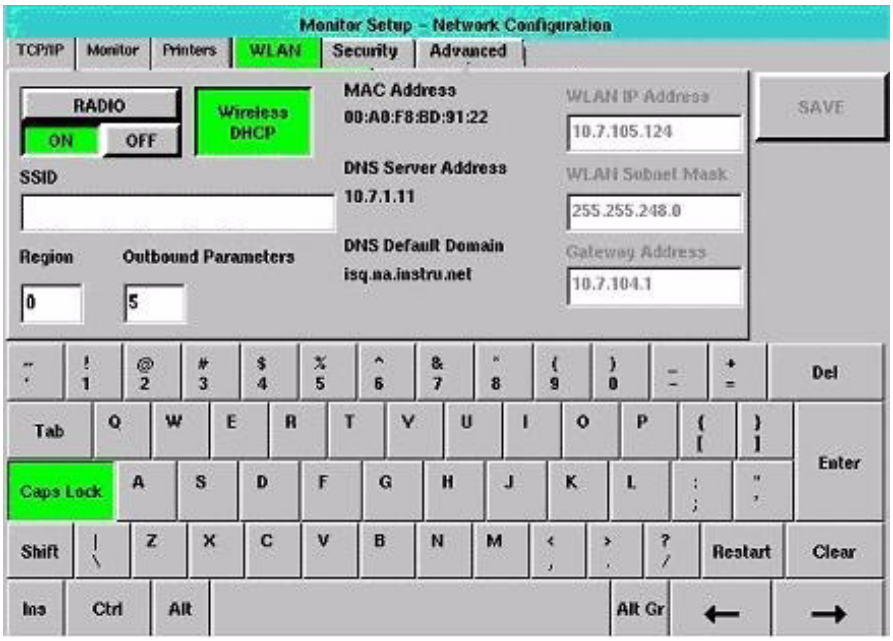


*Figure 2-14: **WLAN** tab*

The tabbing order is **RADIO ON/OFF** >> **SSID** >> **Region** >> **Outbound Parameters** >> **Wireless DHCP** >> **WLAN IP Address** >> **WLAN Subnet Mask** >> **Gateway Address** >> **RADIO ON/OFF**. **WLAN IP Address**, **WLAN Subnet Mask**, and **Gateway Address** are not available in the tabbing order if **Wireless DHCP** is selected. Changes made to this tab's settings take effect after a successful save and monitor reset.

RADIO ON/OFF (default = OFF)

The **RADIO ON/OFF** setting defaults to **OFF** when a radio is present. If this key is toggled to **ON**, and **SAVE** is selected without a valid region defined [refer to *Region (default = blank)* on page 2-22], an error box displays (the radio cannot be switched to ON if the Region setting is invalid). Select **OK** to remove the error box. The **RADIO ON/OFF** key automatically toggles back to **OFF**.

The radio will function only if this key is set to **ON**. Keys, input cells, select boxes, and combo boxes are enabled without regard to the setting of this key. However, WLAN communication only occurs if **ON** is selected.

Note:

Any change in the wireless tabs (except for the setting of the OUTBOUND PARAMETERS input cell) requires a monitor reset before the changes take effect.

To activate the radio-only functions, select **ON**.

Wireless DHCP (default = OFF)

The **Wireless DHCP** tab is similar in function to the **DHCP** key on the **TCP/IP** tab, but for wireless networks. When **Wireless DHCP** is selected, the monitor asks the wireless DHCP server for the following information:

- **WLAN IP Address**
- **WLAN Subnet Mask**
- **Gateway Address**

The affected input cells then display the values provided by the wireless DHCP server, rather than the values from the monitor's non-volatile memory. These cells then become unavailable for selection, to prevent these values from being changed, until **Wireless DHCP** is de-selected.

If Wireless DHCP is selected, as in *Figure 2-14* on page 2-20, **DNS Server Address** and **DNS Default Domain** values display, and the **WLAN IP Address**, **Wireless Subnet Mask**, and **Gateway Address** input cells are unavailable for selection.

When **Wireless DHCP** is not selected, the **DNS Server Address** and **DNS Default Domain** values disappear, and the **WLAN IP Address**, **Wireless Subnet Mask**, and **Gateway Address** input cells are available.

Table 4: Wireless DHCP Input Cells

Cell name	Can the wireless DHCP server provide this information?	Is this cell unavailable if the wireless DHCP server provides the information?	Can the cell be left blank?
WLAN IP Address	Yes	Yes	No
WLAN Subnet Mask	Yes	Yes	No
Gateway Address	Yes	Yes	Yes

Note:

Input cells that display wireless DHCP server-provided data may display values different than what is stored in the monitor's non-volatile memory. DHCP server-provided values are not stored in non-volatile memory.

SSID (default = blank)

The **SSID** cell is used to define the WLAN Service Set Identifier (SSID) setting, which is the name used by acceptable access points (AP) for that WLAN. This field is up to 32 characters long, and it may contain any combination of case-sensitive characters. The default is blank.

Setting SSID and Security Mode

If enabled, WLAN card communication through the wireless network depends on the interaction between the WLAN card SSID setting (refer to *SSID (default = blank)*) and its security settings (refer to *Security Tab* on page 2-24).

The WLAN card SSID and security settings must match the settings of the intended access point (AP). If the settings do not match, then wireless communication cannot occur.

Table 5: WLAN Card and Security States

SSID	Security Mode	Authentication	WEP Keys Match?	Monitor Associated?	Monitor Authenticated?	Can Wireless Communication Occur?
No Match	WEP Disabled	Open	N/A	No	No	No — SSID must always match
No Match	WEP Enabled	Open	N/A	No	No	
No Match	WEP Enabled	Shared Key	N/A	No	No	
SSID Matches	WEP Disabled	Open	N/A	Yes	Yes	Yes, but only if Security Mode on AP matches (WEP optional)
SSID Matches	WEP Enabled	Open	Yes	Yes	Yes	Yes
SSID Matches	WEP Enabled	Open	No	Yes	No	No
SSID Matches	WEP Enabled	Shared Key	Yes	Yes	Yes	Yes
SSID Matches	WEP Enabled	Shared Key	No	No	No	No

Region (default = blank)

This input cell displays the monitor's current setting for the WLAN region. This cell is available for 802.11 radios that are configurable in the field. Region values and their corresponding geographical regions are listed in *Table 6*. The frequencies available in a particular country differ according to the regulations of that country. Consult your national and local regulations.

Table 6: Region Codes

Value	Center Frequency Range	Region
Blank		Disabled
1	2412 to 2472 MHz	Europe (ETSI), except France and Spain
2	2412 to 2462 MHz	North America

Table 6: Region Codes

Value	Center Frequency Range	Region
3	2412 to 2472 MHz	Japan (MKK)
4	2457 to 2462 and 2484 MHz	Japan
5	2412 to 2472 MHz	France
6	2457 to 2462 MHz	Spain

Note:

*Selecting **SAVE** when the currently entered value for Region is not valid displays the "Cannot switch Radio ON with invalid region" error dialog box. Selecting **OK** toggles **RADIO ON/OFF** to **OFF**, disabling the radio.*

Outbound Parameters (default = 5)

This input cell displays this monitor's configuration setting for the number of parameters that are displayed in bed selection dialog boxes. Valid values range from 0 through 6 (default = 5), with blank equating to 0.

MAC Address

The radio's assigned MAC address (in hexadecimal) displays below this label.

DNS Server Address and DNS Default Domain

The radio's DHCP server-assigned DNS server address (in IP format) and DNS default domain name (in text) display below these labels, but only when **Wireless DHCP** is selected.

WLAN IP Address (default = 0.0.0.0)

Allows the operator to specify the IP address for the wireless network interface, when **Wireless DHCP** is not selected.

WLAN Subnet Mask (default = 0.0.0.0)

Allows the operator to identify which parts of the wireless IP address to use for TCP/IP subnet determination, when **Wireless DHCP** is not selected. Wireless subnet mask is not related to the Monitoring network's subnet name or subnet mask.

Gateway Address (default = 0.0.0.0)

Allows the operator to specify the IP address of a wireless TCP/IP gateway (bridge or router) through which wireless communication to other devices should flow, when **Wireless DHCP** is not selected. The Gateway address on the WLAN tab is not related to the Gateway address on the TCP/IP tab.

Security Tab

The **Security** tab provides access to the WLAN security settings. The **Security** tab only displays on monitors that are configured for wireless operation.

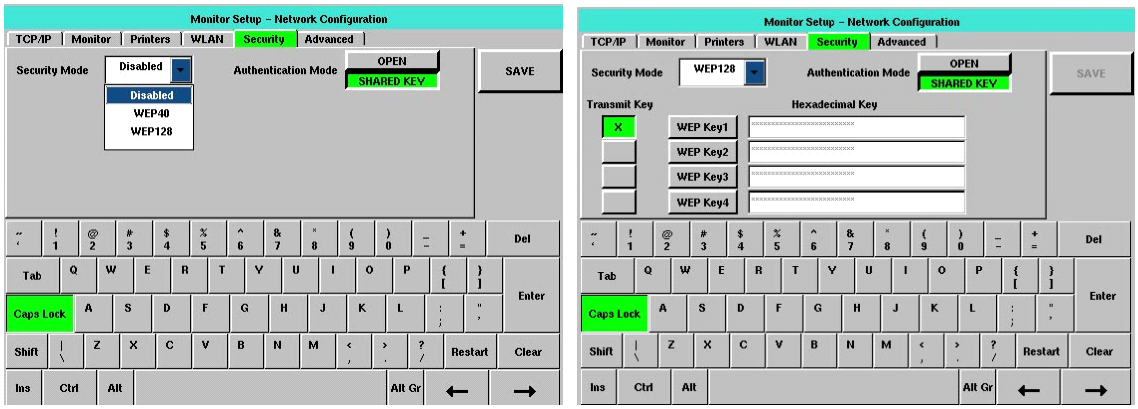


Figure 2-15: Security tab

In the left portion of *Figure 2-15*, **Security Mode** is set to **Disabled** in the **Security Mode** combo box pull-down menu. In the right portion of *Figure 2-15*, **Security Mode** is set to **WEP128**, after entering hexadecimal keys.

Note:

*Any entered WEP keys are erased if Security Mode is set to **Disabled** and the new setting is saved. If **Disabled** is selected but not saved, the WEP keys are not erased.*

The tabbing order depends upon the currently selected setting for **Security Mode**.

When **Security Mode** is set to **Disabled**, the tabbing order is **Security Mode** >> **SAVE** >> **Security Mode**.

When **Security Mode** is set to a WEP setting, the tabbing order is **Security Mode** >> **Authentication Mode** >> **Transmit** (**WEP Key1**) >> **Transmit** (**WEP Key2**) >> **Transmit** (**WEP Key 3**) >> **Transmit** (**WEP Key4**) >> **WEP Key1** >> **WEP Key2** >> **WEP Key3** >> **WEP Key4** >> **Security Mode**. Changes made to this tab's settings take effect after a successful save and monitor reset.

Note:

- *In the tabbing order, the position of input focus on the combo boxes and the EDIT keys is not visually apparent. Input focus on a key can be determined by selecting the ENTER key on the keyboard (the key highlights). Selecting one of the WEP keys also clears the input cell to its right, enables that input cell and gives it input focus). Input focus on a combo box can be determined by using the up or down arrow keys on a USB keyboard to move through the list items.*
- *The tabbing order skips the SAVE key when that key is unavailable.*

Security Mode

A combo box displays the monitor's current **Security Mode** selection and provides the operator with a way to change that selection. This setting determines whether WLAN operation is disabled (not encrypted) or is enabled with encryption using either the WEP40 or the WEP128 protocols.

Whenever **Disabled** is selected, the only other items displayed within the tab are the Authentication Mode key (disabled with **OPEN** selected) and the **SAVE** key. If **Disabled** is selected and saved, the **SAVE** key becomes unavailable.

Selecting **WEP40** or **WEP128** enables the **Authentication Mode** setting (the selection does not change) and displays **Transmit Key** with four keys below it. **WEP Key1** through **WEP Key4** display with corresponding input cells.

When **Security Mode** is set to **WEP40** or **WEP128**, the WEP keys and the key sizes for the WLAN APs and wireless monitors must be identical for wireless communication to occur.

Changing **Security Mode** from **Disabled** to **WEP40** or **WEP128** causes a working WLAN to stop working, if the WEP keys and key sizes do not exactly match throughout the WLAN.

If the WLAN security settings have never been configured, or if you are changing the setting from **Disabled** to **WEP40** or **WEP128**, then the four WEP key input cells are blank. If the WLAN security settings were previously configured, then the four WEP key input cells reflect whether that WEP key was defined (see *WEP Keys*).

Transmit Key

These four keys indicate which of the available WEP Keys is used for wireless data transmission. By default, none of these keys are selected. Selecting any of these four keys displays an “x“ mark within that key and cancels the selection of any other previously selected transmit key.

WEP Keys

A WEP key is either 10 or 26 hexadecimal characters in length, depending upon whether the selected WEP key size is 40 or 128 bits, respectively.

A WEP key can be cleared or entered. After it has been entered, the hexadecimal entry cannot be edited (it must be re-entered). The WEP key input cells, labeled **WEP Key1**, **WEP Key2**, **WEP Key3**, and **WEP Key4**, indicate whether that WEP key is defined for use when WEP security is selected. These input cells are blank if a WEP key has not been entered. If you accidentally delete a WEP key that was needed, and you have not saved this change, you can restore the WEP key setting by exiting NETWORK SETUP and then returning to NETWORK SETUP.

A WEP key input cell reflects the characters being typed during input of a WEP key. After the WEP key is stored, the input cell for the entered WEP keys displays one asterisk for each character in the stored WEP key (10 asterisks if the selected key size is 40; 26 asterisks if it is 128). This indicates that the key was defined, but the value is hidden for security purposes.

If the WEP key is non-null when a key size change occurs, then the contents of the WEP key input cells clear.

Selecting a WEP key

Selecting any of these four keys (**WEP Key1**, **WEP Key2**, **WEP Key3**, or **WEP Key4**) highlights that key, disables any available WEP key input cell, enables the WEP key input cell to the right of the selected key, clears the contents of the enabled input cell, and positions the cursor at the far left of that input cell.

Authentication Mode

The 802.11b WLAN cards (radios) that Ultraview SL monitors use for wireless networking support two methods of authentication between wireless clients and the AP: Open and Shared Key. Wireless networking is only available if the authentication modes of the AP and the WLAN card match.

Setting **Security Mode** to **Disabled** disables this key, with **OPEN** selected.

OPEN Authentication

Open authentication simply requires that the SSID for the monitor's WLAN card match that of the AP. The AP must also be set for open authentication. Refer to *Table 5* on page 2-22.

Shared Key authentication

In Shared Key authentication, the AP sends the monitor's WLAN card a challenge text string that the WLAN card encrypts (using its WEP key) before returning it to the AP. If the monitor's WLAN card WEP key does not match the AP's WEP key, the AP rejects the encrypted text and will not allow the WLAN card to associate with it. Refer to *Table 5* on page 2-22.

Advanced Tab

The **Advanced** tab provides access to the advanced WLAN settings. The **Advanced** tab only displays on monitors that are configured for wireless operation. The left window of *Figure 2-16* displays the Advanced tab; the right window illustrates the window with the **Data Rate** combo box displayed. Changes made to this tab's settings take effect after a successful save and monitor reset.

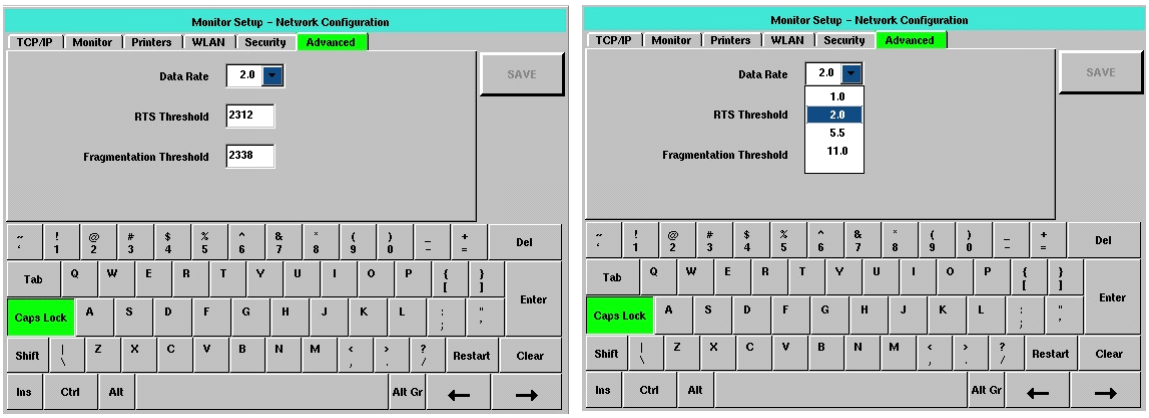


*Figure 2-16: **Advanced** tab*

Editing this tab is performed as described in *Editing Tab Fields* on page 2-13. The tabbing order is **Data Rate** >> **RTS Threshold** >> **Fragmentation Threshold** >> **Data Rate**.

Note:

In the tabbing order, position of input focus on the combo box is not visually apparent. Input focus on a combo box can be determined by using the up or down arrow keys on a USB keyboard to move through the list items.

Data Rate (default = blank)

A combo box displays the current WLAN **Data Rate** selection. The operator may change that selection using this combo box.

When selecting a Data Rate, select the maximum data rate that the WLAN interface should use when sending unicast and multicast data packets. The WLAN interface uses a lower rate if reliable network communication cannot occur at the selected higher data rate.

RTS Threshold (default = 0)

Valid values are in the range of 0 to 2339, inclusive.

Fragmentation Threshold (default = 0)

Valid values are in the range of 256 to 2338, inclusive. The default setting is **0**.

Network Configuration Messages

The following messages may occur if a networking entry is misconfigured. The default setting is **0**.

Cannot switch Radio ON with invalid region

Monitors display this warning if the value displayed in the **Region** input cell on the **WLAN** tab [refer to *Region (default = blank)* on page 2-22] is invalid and SAVE is selected.

TTL XX is out of range (either < 1 or > 64)

Where XX is the value entered in the **TTL** cell on the **Monitors** tab. (Monitors display this warning when the **TTL** input cell loses focus if the entered value is not within the valid range.) If the value entered is nonnumeric, then the displayed value changes back to the most recently saved numeric value.

WEP KeyY invalid. This key should be 26 HEXADECIMAL characters

(when WEP128 is selected);

-OR-

WEP KeyY invalid. This key should be 10 HEXADECIMAL characters

(when WEP40 is selected).

Monitors display one of these warnings if the value entered in that WEP key's input cell on the **Security** tab contains a nonhexadecimal character and **SAVE** is selected.

Wireless configuration out or range error messages

Monitors display one of the following warning messages if that input cell's value for the WLAN is out of range, and SAVE is selected. XXXXX represents the entered value.

Wireless Fragmentation Threshold XXXXX is out of range (either <256 or > 2338) (**Advanced** tab).

Wireless RTS threshold XXXXX is out of range (either <0 or >2339) (**Advanced** tab).

Wireless outbound parameters XXXXX is out of range (either <0 or > 6) (**WLAN** tab).

Invalid Region Code — XXX (either <0 or > 99) (**WLAN** tab).

Note:

If the invalid IP address or subnet mask is related to use of the WLAN, monitors that are configured for radio/WLAN operation append "WLAN" to the start of the error messages describe below.

Gateway Address xx.x.xxx.xxx is out of range or invalid

Refers to the **WLAN** tab. Monitors display this on the keyboard window's error line or in a warning dialog box if the form of the IP address is invalid (not in the form xxx.xxx.xxx.xxx, where X is a number) and SAVE is selected.

WLAN IP address xxxxx is out of range or invalid

Refers to the **WLAN** tab. Same as for *Gateway Address xx.x.xxx.xxx is out of range or invalid*, where xxxxx is the entered IP address.

WLAN Subnet Mask xx.x.xxx.xxx is out of range or invalid

Refers to the **WLAN** tab. Same as for *Gateway Address xx.x.xxx.xxx is out of range or invalid*.

Serial Ports

Refer to *Directory of Keys* on page 7-1 for the menu structure.

Patient Data Logger (Option R)

The Patient Data Logger option automatically sends patient vital signs from the monitor to a serial external device, such as a printer or a terminal. Episodic patient data is also sampled and transmitted. The output is in the form of ASCII text byte strings and is printed using standard RS-232 serial communications via the monitor's serial port (refer to the *Ultraview SL Operations Manual*, P/N 070-1150-xx, located on CD-ROM P/N 084-1101-xx for configuration information).

This option continues to send data whether the external device is on-line or off-line. Data transmission can be stopped by reassigning the data port or disabling the Patient Data Logger option.

Communication between the monitor and the external device is set up by assigning the serial port to Patient Data Logger and then adjusting the serial port settings. The various serial settings can be adjusted to suit the device attached to the serial port.

To set up Patient Data Logger:

1 Touch MONITOR SETUP.

2 Touch PRIVILEGED ACCESS.

3 Enter the biomed password (default is **biomed**).

4 Touch SERIAL PORTS.

5 Touch ASSIGNMENT.

6 Touch DATA LOGGER.

7 Touch PREVIOUS MENU.

Vitalink

Vitalink is a Draeger-defined asynchronous serial communication protocol for use only with Draeger devices.

To set up Vitalink:

1 Touch MONITOR SETUP.

2 Touch PRIVILEGED ACCESS.

3 Enter the biomed password (default is **biomed**).

4 Touch SERIAL PORTS.

5 Touch ASSIGNMENT.

6 Touch VITALINK.

7 Touch PREVIOUS MENU.

Serial Settings

To set serial settings:

1 Touch SETTINGS.

2 Touch the desired setting key(s) to display and set the desired settings.

3 Touch NORMAL SCREEN to effect changes.

Monitor Calibration

The MONITOR CALIBRATION key in the **Biomed Level** menu allows you to perform a touchscreen calibration in the event the touchscreen becomes difficult to use or a replacement has been installed. Refer to *Touchscreen Calibration* on page 4-4 for instructions on performing this calibration.

Change Biomed Password

The CHANGE BIOMED PASSWORD key in the **Biomed Level** menu enables you to change the password used to access the **Biomed Level** menu.

To change the biomed password:

1 Enter the current biomed password in the **Password** field using the on-screen keyboard (passwords are not case-sensitive).

2 Enter the new biomed password in the **New Password** field and enter the same password again in the **Verify Password** field using the on-screen keyboard.

Note:

If the biomed password is forgotten, contact your Spacelabs Medical Field Service Engineer.

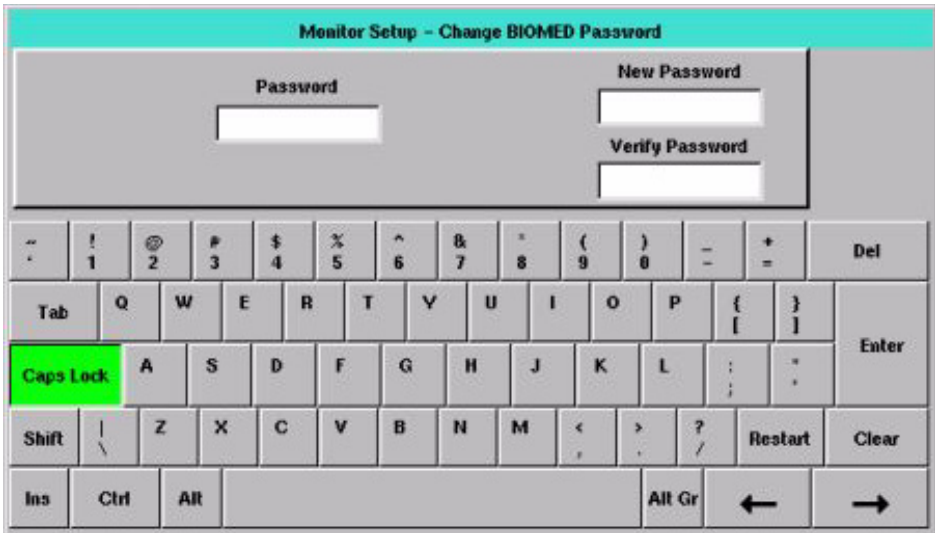


Figure 2-17: Change BIOMED Password dialog box

Clinical Menu

The CLINICAL MENU key in the **Biomed Level** menu provides access to several features described in the sections that follow. Refer to *Directory of Keys* on page 7-1 for the menu structure.

Time/Date

The TIME/DATE key accesses the **Monitor Setup - Time/Date** menu. The current time or date displays above the menu. The time displays in either a 12- or 24-hour format. Network monitors display the network time; standalone monitors display the internal system time.

- TIME/DATE — Select TIME or DATE, use the arrow keys to set the correct time or date, and touch ENTER.
- 24 HOURS — Displays the time in a 24-hour format. Touch ENTER to complete the selection.
- AM/PM — Select AM or PM to display the time in a 12-hour format, and then touch ENTER.

Note:

Setting the time on any networked monitor sets the time for all monitors on that network.

Preselected Recordings

Refer to the *Printing* chapter in the *Ultraview SL Operations Manual* (P/N 070-1150-xx), located on CD-ROM P/N 084-1101-xx, for information regarding preselected recordings.

Units of Measurement

The UNITS OF MEASURE key provides access to the units of measurement that the monitor uses for input, display, and printing of values for pressure, height, and weight measurements. Each key's label indicates the available selections. Reset the monitor after making changes in this menu.

User Access

The USER ACCESS key allows the system administrator to preset certain functions and features of the monitor for availability to non-privileged-access users.

- PATIENT TYPE / ON/OFF — Enables (ON) or disables (OFF) the “Patient Type” selection in the **Admit/ Discharge** dialog box.
- PARAMETER CONFIG / ON/OFF (bedside monitors only) — Displays (ON) or removes (OFF) the PARAMETER CONFIG key in the **Monitor Config** menu.
- RECORDING DURATION / ON/OFF — Displays (ON) or removes (OFF) the RECORDING DURATION key in the **Recorder Config** menu.
- SUBNET ACCESS / ON/OFF — Select ON to display keys for other care areas (subnets) within bed selection windows for features such as Alarm Watch, Remote View, or Screen Format.
- DEFAULT ENG. SAV MODE / ON/OFF — Controls the monitor’s default-energy-saving power mode ON or OFF and changes the setting of the ENERGY SAVING MODE / ON/OFF key that appears when the monitor is operating on battery power.

Alarm Setup

Touch the ALARM SETUP key to display the following keys:

- REMOTE ACCESS / ON/OFF — Select ON to allow alarm limits from this monitor’s parameters to be changed remotely (from central monitors or from bedside monitors via Remote View).

  Selecting OFF ensures that alarm limits for this monitor’s parameters can only be changed at this monitor.
- ALARM SUSPEND / ON/OFF — Select ON to enable access to the TONE RESET/ALM SUSPEND key’s Alarm Suspend function.
- TREND SUSPEND / ON/OFF — Select ON to allow trending to occur when all alarms are suspended via the ALARM SUSPEND key.
- ALARM RELAY — Allows characteristics of the monitor’s external alarm relay to be defined. When an alarm occurs, this relay can activate an external device to identify which monitor is in alarm. In general terms, monitors activate their alarm relay whenever an alarm is occurring on that monitor.
  - RELAY TIMEOUT / 0 SEC/10 SEC — Select 0 SEC to deactivate the alarm relay when the alarm ends. Select 10 SEC to deactivate the alarm relay 10 seconds after the alarm ends.
  - FLASHING/STEADY ON — Controls whether the alarm relay is intermittently activated (FLASHING) or is continuously activated (STEADY ON) when an alarm occurs. Intermittent activation is normally used when connecting to an external light. Continuous activation is normally used when connecting to a nurse call button (or similar equipment).

Note:

Setting the monitor ALARM RELAY to either FLASHING or STEADY ON does not affect the 91369 embedded nurse alert light.

- ALARM LEVEL — The alarm relay can be activated for all alarms or for alarms at or above the selected priority only. Selections of HIGH, MEDIUM, and LOW are available. For example, selecting MEDIUM results in activation of the alarm relay for HIGH and MEDIUM priority alarms, but not for LOW priority alarms.

- QRS/SPO2 TONE ENABLE / ALWAYS/DURING ALARM — Controls whether the monitor sounds the QRS or SpO_2 tone all the time (ALWAYS) or only during alarm conditions (DURING ALARM). The QRS or SpO_2 tone must also be enabled using the controls within those parameters' menus.

Alarm Watch Setup

The ALARM WATCH SETUP key controls how the monitor responds to alarm watch messages received from other monitors.

- ROTATE ALARM WATCH / ON/OFF — This key enables (ON) and disables (OFF) the alarm watch rotation feature (default is OFF).
- ALARM WATCH ROTATION / PRIORITY/SIMPLE — When a monitor receives more than one alarm watch message at a time, it uses a "first-in, first-out" rotation scheme to display the alarming parameters. This key is only enabled when ROTATE ALARM WATCH is enabled. The following choices of rotation schemes are available:
  - PRIORITY rotation cycles through the alarming parameters based on each parameter's alarm priority (for example, parameters with high-priority alarms display before parameters with medium- or low-priority alarms).
  - SIMPLE rotation cycles through the alarming parameters in the order that they go into alarm (first come, first served).
- ROTATION TIME / 15 SEC/30 SEC — You can choose to display an alarm watch for either 15 or 30 seconds before cycling to the next alarm watch if there are two or more alarm-watched beds in alarm. This key is only enabled when ROTATE ALARM WATCH is enabled.

Change Clinical Password

The CHANGE CLINICAL PASSWORD key enables you to change the password used to access the **Clinical Level** menu.

To change the clinical password:

1 Enter the current clinical password in the **Password** field using the on-screen keyboard (passwords are not case-sensitive).

2 Enter the new clinical password in the **New Password** field and enter the same password again in the **Verify Password** field using the on-screen keyboard.

Note:

If the clinical password is forgotten, contact your system administrator.

Reset Monitor

The RESET MONITOR key allows you to reboot the monitor after changing settings for the following items (the monitor must be rebooted before these changes can take effect):

- Subnet access
- Units of measurement

Touching the RESET MONITOR key displays the **Reset Monitor** dialog box. Select **Reset Monitor** to proceed or **Cancel Reset** to cancel.

Note:

Patient data are preserved when the monitor is restarted using the RESET MONITOR key.

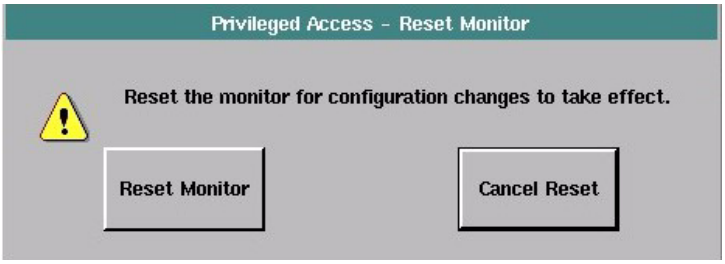


Figure 2-18: Privileged Access - Reset Monitor dialog box

Tone Configuration

The TONE CONFIGURATION key in the **Biomed Level** menu enables you to configure the monitor's alarm tone configuration. Refer to *Directory of Keys* on page 7-1 for the menu structure.

ISO Standard Alarm Tones

The ISO STANDARD ALARM TONES key enables you to configure the monitor for ISO (International Standards Organization) standard alarm tones and reset the values displayed in the alarm period keys, within the **Configurable Alarm Tones** menu, back to default settings.

Configurable Alarm Tones

The CONFIGURABLE ALARM TONES key enables you to configure the monitor for ISO standard alarm tones with a configurable repetition rate.

- HIGH, MEDIUM, LOW — The values displayed on the lower lines of the HIGH, MEDIUM, and LOW keys are the current settings (within that key's adjustment range) for the repetition rate for that alarm's priority.

Table 7: Alarm Period Default Values

Selected Alarm Period Key	Adjustment Range (and Default Value)	Enables Arrow Keys and Deselects
HIGH	0 to 30 seconds (15 seconds)	MEDIUM and LOW
MEDIUM	0 to 45 seconds (30 seconds)	HIGH and LOW
LOW	0 to 45 seconds (30 seconds)	HIGH and MEDIUM

- ↑ and ↓ — The up and down arrow keys are enabled when one of the alarm period keys is selected. The arrow keys are used to adjust the repetition rate for the selected alarm priority in five-second increments within that priority's adjustment range.
- FACTORY DEFAULTS — This key deselects all the period keys, resets their values to the ISO standard values, and disables the arrow keys.

Continuous Alarm Tones

The CONTINUOUS ALARM TONES key enables you to configure the monitor for continuous alarm tones. This has no affect on the alarm period keys in the **Tone Configuration** menu.

Alarm Tone Access

The TONE ACCESS / ON/OFF key enables you to configure the monitor for user alarm tone access. The TONE / ON/OFF key in the **Alarm Tone**, **Remote Alarm**, and **Alarm Watch Tone** menus is not displayed if OFF is selected. This has no affect on the alarm period keys in the **Tone Configuration** menu.

Edit Drug List

The **EDIT DRUG LIST** key in the **Biomed Level** menu enables you to input and edit the master drug list from any monitor. The master drug list can then be received by any monitor and stored in that monitor's non-volatile memory. The master drug list can store up to 16 drug names and associated data.

Prior to initially storing the drug list in a monitor (either via direct input or transfer), all monitors have blank drug list names and display defaults that correspond to the standard drugs A through D (refer to *Table 8*). This set of four default values is repeated for every fourth item in the drug list (for example, default settings for the 5th and 9th drugs in the list are identical to the settings for Drug A, the 1st drug in the list).

Table 8: Standard Drug Values

Key	Neonatal Drug	Adult Drug
A	Dopamine or Dobutamine	Dopamine or Dobutamine
B	Isoproterenol	Lidocaine, Pronestyl or Bretylium
C	Tolazoline	Nitroglycerine or Levophed
D	Nitroprusside	Nitroprusside

Touch EDIT DRUG LIST to display the **Drug List Selection Menu** (*Figure 2-19*). Selecting any drug name from this list highlights that line. The drug list may be blank (if all the entries are blank) or display one or more blank lines.

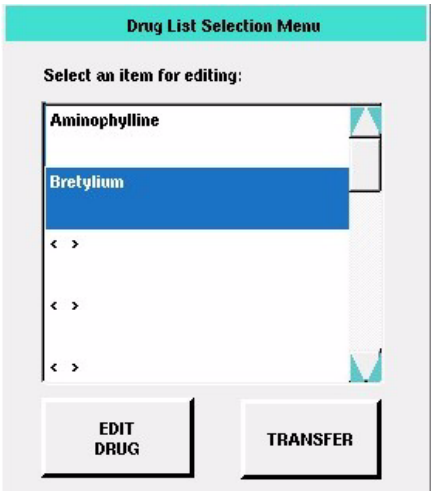


Figure 2-19: Drug List Selection Menu

Note:

To remove a drug from this list, you must overwrite the entry with blanks.

Touch EDIT DRUG to display the **Edit Drug** dialog box (*Figure 2-20*). Enter information in the fields using the on-screen keyboard. Touch SAVE to save the data to the drug list.

Touch TRANSFER to transfer this monitor's drug list information to other monitors. Refer to *Define Patient Identifier (PI) String* on page 2-39 for information on using the transfer feature.

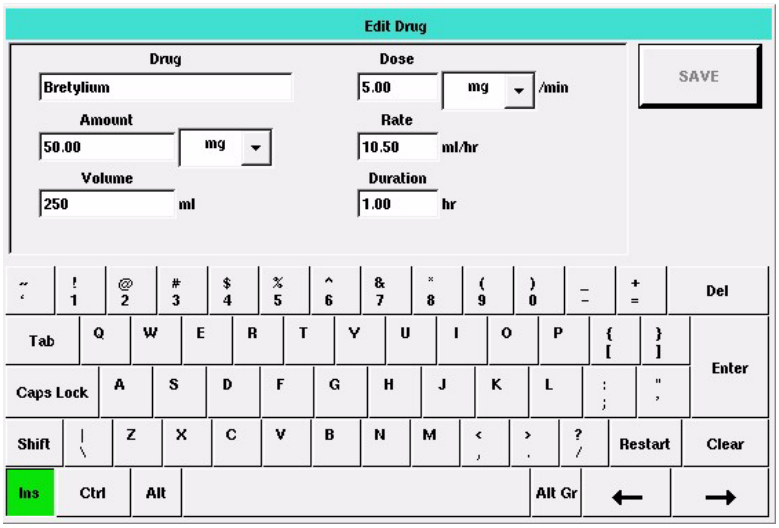


Figure 2-20: Edit Drug dialog box

Refer to the *Ultraview SL Operations Manual* (P/N 070-1150-xx) located on CD-ROM P/N 084-1101-xx for additional information.

Minimum Volume

The MINIMUM VOLUME / ON/OFF key the **Biomed Level** menu locks (ON) the current alarm tone volume setting as the minimum alarm tone volume. Visually verify the volume setting before selecting ON.

System Information

The SYSTEM INFO key in the **Biomed Level** menu accesses the monitor's **System Information - Digital** screen (actual data may differ from the example in *Figure 2-21*).

Figure 2-21: System Information screen - Digital

DIGITAL

This page displays information related to the TTL, system, diagnostics, and software configuration.

The presence or absence of the WLAN key in the DIGITAL system information window is the only indication of whether or not this monitor supports wireless networking.

PRINT

Selecting this key prints whatever information is displayed in the window above it. All System Information windows display this key.

ANALOG

Touch ANALOG to display the analog system information.

- While the monitor is connected to AC power, **AC** displays below the **AC/DC** heading and the current **battery charge current** and **battery resistance** values display, along with values for various powers and temperatures (actual data may differ from the example in *Figure 2-22*).

Figure 2-22: Analog system information - monitor connected to AC power

- If the monitor is not connected to AC power, **DC** displays below the **AC/DC** heading (actual data may differ from the example in *Figure 2-23*), and the current battery **voltage** and **%full** values display, along with values for various powers and temperatures (**line voltage** displays asterisks).

Figure 2-23: Analog system information - monitor not connected to AC power

WLAN

Selecting the WLAN key (only displayed if a radio is detected) displays the WLAN page.

Figure 2-24: WLAN interface information

Information related to the current use of the wireless monitor's WLAN operation appears at the top of this page. The radio's list of detected APs displays below Available Access Points.

Current WLAN Interface

- **WLAN** Interface indicates whether the WLAN card is currently communicating with an access point ("ASSOCIATED" = it is communicating; "UNASSOCIATED" = it is not communicating).
- **SSID** lists the text string input for the SSID entered in the **WLAN** tab of the **BIOMED LEVEL** menu, under **Network Setup**.
- **Station MAC Address** and **IP Address** list the current MAC address and IP address of the WLAN card, respectively.
- **Channel** identifies which of the available wireless channels (01 to 14 decimal) the WLAN card is currently using to communicate.
- **Tx Rate** indicates which data rate (in Mbps) the WLAN card is currently using.
- **Signal Strength** indicates the current received signal strength (value from 1 to 100).
- **Firmware Version** indicates the version of the firmware (software) in the WLAN card.

Available Access Points

The list of available access points lists the MAC address, the channel (Ch.), and the signal strength (Str.) of all APs that match the displayed SSID value. An asterisk (*) to the left of an AP indicates that the WLAN card is currently associated with this AP.

REFRESH

Selecting **REFRESH** initiates an update of the page.The WLAN card immediately scans for available APs and associates with one of them. This process takes approximately 1 second.

System Information Screen Updates

The contents of the WLAN screen update in one of two ways:

Approximately every 10 seconds, a monitor prompts the WLAN card for current statistics. The monitor does not otherwise instruct the WLAN card to perform any action.

Selecting **REFRESH** forces the WLAN card to disassociate or disconnect from access points (which causes the WLAN card to scan for available access points) before the monitor asks for current statistics from the WLAN card. This action immediately updates the screen.

In either instance, the monitor displays the information provided by the WLAN card.

The WLAN card firmware updates its list of available access points for one of three reasons:

- When the WLAN card becomes unable to communicate with the access point;
- When the WLAN card is told to disassociate or disconnect from an access point (for example, after the user selects **REFRESH**); or
- Approximately every 5 minutes, if neither of the above instances occurs beforehand.

Define Patient Identifier (PI) String

The network-based Remote View and Alarm Watch features enable caregivers to monitor a patient's condition by displaying that patient's data on monitors not connected to the patient.

To minimize any confusion of patient identity, any monitor that displays more than one patient's data uses a dividing line to separate the data. The monitor also displays identifying information in the waveform zone for every patient whose data is being remotely displayed. The identifying information, which displays in the lower left corner of the waveform zone, consists of the monitor's five-character Monitor Name and a configurable Patient Identifier (PI) string, which can be up to 40 characters in length.

To create the PI string, monitors gather identifying data from the Global Data System (GDS) memory of the remote monitor as required by the PI Config string definition. Monitors then display this PI string to the right of the monitor's name at the bottom of the Remote View or Alarm Watch display zone. This PI string is re-evaluated when a new patient is admitted, a patient is discharged, a bed location changes, or any identifying parameter changes.

At run-time, patient name items defined for inclusion in the PI string may be truncated to ensure they fit within the available display space; general items are never truncated. Monitors also truncate the PI string so that it does not run into or behind the parameter key and to ensure that it does not exceed the 40-character limit.

Configuring the PI String

Touch DEFINE PI STRING in the **Biomed Level** menu to display the **Define Patient Identifier String** dialog box (*Figure 2-25*).

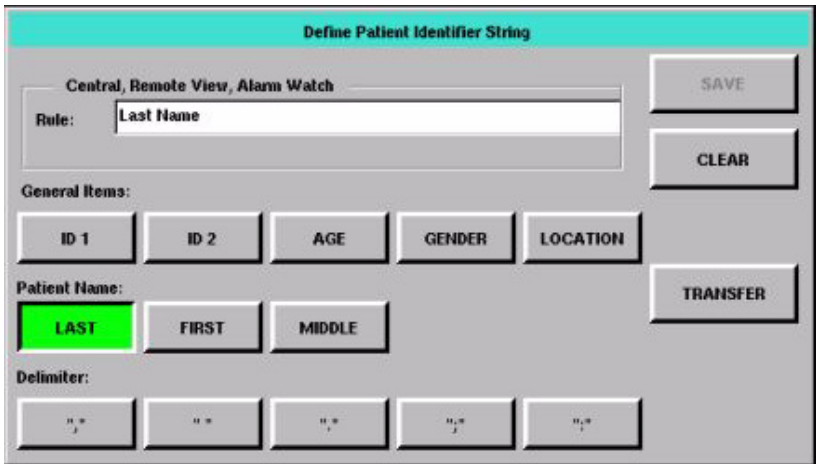


Figure 2-25: Define Patient Identifier String dialog box

The current PI string definition is displayed in the **Rule** box and is defined using the three rows of item keys (**General Items**, **Patient Name**, and **Delimiter**). Touch a key in one of these rows to append that item to the end of the Rule's existing contents. The items are appended exactly as they are selected.

For example:

- Selecting the same **Delimiter** (separator) twice inserts that delimiter into the **Rule** box twice.
- Touching AGE and then GENDER inserts the patient's age and gender into the **Rule** box without a separating character.
- Touching AGE, a delimiter, and then GENDER ensures that consecutive items are separated.

No more than two consecutive delimiter strings can be added to the **Rule** box at one time. To display identifying information, the monitor gathers the PI data associated with the items displayed in the **Rule** box from the remote monitor's GDS.

The three keys on the right side of the Define Patient Identifier String dialog box enable you to clear, save, or transfer the Rule as follows:

- Touch CLEAR to clear the **Rule** box.
- Touch SAVE to save the contents of the **Rule** box as the PI string definition. Below the **Delimiter** keys, the monitor displays the message *Configuration Saved* if errors are not detected and displays the message *Unable to save PI Config string, try again* if errors are detected.
- Touch TRANSFER to transfer this monitor's PI string definition to other selected monitors.

To configure the strings on multiple monitors:

1. Define and save the PI string on one monitor using the **Define Patient Identifier String** dialog box.
2. Touch the TRANSFER key to display the **Transfer Patient Identifier Configuration** dialog box.

Note:

*The TRANSFER key is unavailable if the **Rule** box is blank or the contents have been changed but not saved.*

3 Select the destination monitors, then touch the TRANSFER key in the **Transfer Patient Identifier Configuration** dialog box to transfer the data to the other monitors. The message *Transfer Complete* displays following a successful transfer.

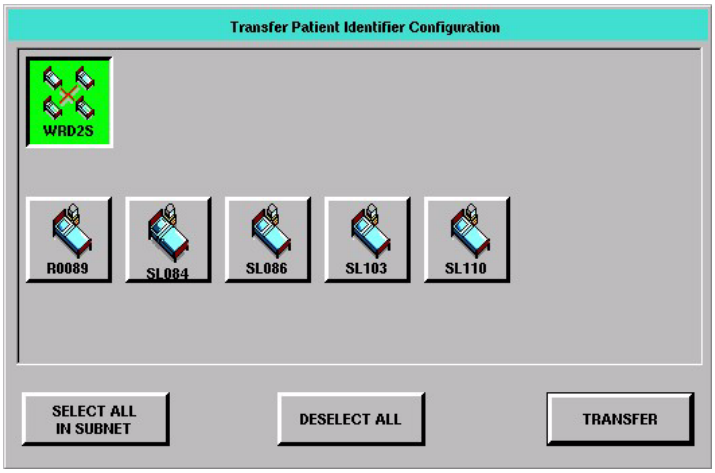


Figure 2-26: Transfer Patient Identifier Configuration dialog box

The other two keys at the bottom of the Transfer Patient Identifier Configuration dialog box perform the following functions:

- SELECT ALL IN SUBNET — Selects all the monitors within the currently selected subnet with one key touch.
- DESELECT ALL — Deselects all the monitors in all the subnets with one key touch.

The list of monitor keys displayed below the subnet keys may include monitors that do not support the PI string transfer protocol if legacy products are present. Keys for those monitors are always unavailable.

Note:

The SELECT ALL IN SUBNET and DESELECT ALL keys are unavailable if no monitors that support the transfer protocol exist within the selected subnet. Selection or deselection only applies to the keys for 91xxx monitors.

START/END CASE OPTIONS

Touch the START/END CASE OPTIONS key to display the **Start/End Case Options** dialog box.

Note:

If option D, Perioperative, is not activated, the START/END CASE OPTIONS key does not appear.

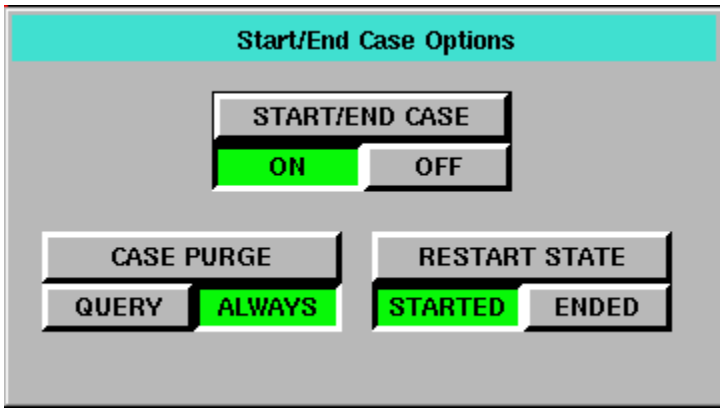


*Figure 2-27: **Start/End Case** dialog box*

Touch START/END CASE /ON to turn ON Start Case/End Case features, or touch START/END CASE /OFF to turn the features OFF. The monitor must be reset for these changes to take effect, and the **Reset Monitor** dialog box (refer to *Figure 2-29* on page 2-43) displays after any change in the **Start/End Case Options** dialog box.

The START/END CASE ON/OFF setting determines whether the following keys are enabled or disabled.

CASE PURGE QUERY/ALWAYS

The CASE PURGE /QUERY key determines whether the **Purge patient data?** confirmation window (refer to *Figure 2-28* on page 2-42) displays after the user touches KEEP SETTINGS on the **Keep Settings?** dialog box.

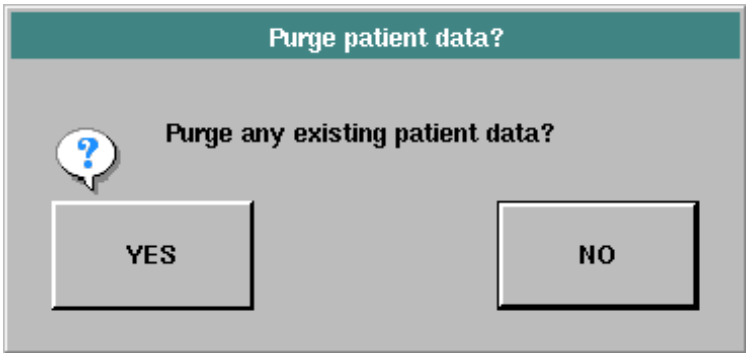


*Figure 2-28: **Purge patient data** confirmation window*

Touch CASE PURGE /QUERY to prompt the user with the **Purge Data** confirmation window when the user touches END CASE.

Touch CASE PURGE /ALWAYS to purge all patient data when the user touches END CASE.

RESTART STATE STARTED/ENDED

Touch the RESTART STATE /STARTED key to set the default power ON state of the monitor to case mode. When the monitor starts from a cold boot, it will start up with case mode enabled.

Touch the RESTART STATE /ENDED key to set the default power ON state of the monitor to non-case mode. Refer to the *Ultraview SL Operations Manual* (P/N 070-1150-xx, located on CD-ROM P/N 084-1101-xx) for how to use Start Case and End Case featues.

Reset Monitor

The RESET MONITOR key in the Biomed Level menu allows you to reset the monitor after changing settings for the following items (the monitor must be reset before the changes can take effect):

- Monitor ID
- Monitor Name
- Subnet Name
- IP configurations
- Start Case/End Case options

Touching the RESET MONITOR key displays the **Reset Monitor** dialog box. Select **Reset Monitor** to proceed or **Cancel Reset** to cancel.

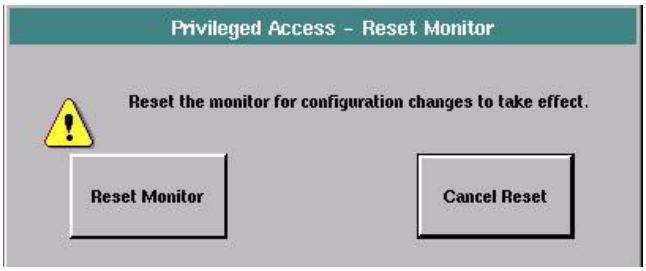


Figure 2-29: Privileged Access - Reset Monitor dialog box

Theory

Contents

Overview

A typical monitor configuration consists of these major components:

- Monitor
- DC power supply
- Parameter module

There may also be additional hardware devices present, such as a mouse, keyboard, and barcode scanner.

The monitor may also be used in conjunction with other hardware components, such as:

- 90491/90499 module housings
- Flexport system interface
- Gas analyzer
- External display

Major System Components

Main Enclosure

The main enclosure includes the CPU, Interconnect, and I/O PCBAs, with one integrated module slot. The main enclosure does not include an AC-to-DC power supply. AC-to-DC power conversion is provided by an external DC supply. The external supply provides 18 VDC, which is internally converted to generate appropriate operating voltages.

The data processing and control hardware all reside on a single CPU PCBA consisting of:

- Memory subsystem that incorporates Flash, synchronous DRAM, SRAM, and NVRAM.
- Host subsystem that runs the system software and interacts with peripheral devices.
- Graphics subsystem that generates the display.

External Connectors

The monitor's external connectors are listed in *Table 1*.

Table 1: External Connectors

Reference	Connector	Description	Pinout
❷ *Figure 2-3* on page 2-4	5-pin DIN male	Power input	3 RETURN 4 +18 Input
❸ *Figure 2-3* on page 2-4	9-pin	SDLC connector	1 GND 2 Data + 3 Data - 4 +5 V 5 +12 V 6 Clock + 7 Clock - 8 -12 V 9 GND

Table 1: External Connectors (continued)

Reference	Connector	Description	Pinout
❹ *Figure 2-3* on page 2-4	DB15HD female	Alarm relay output	1 Alarm 0 Common 2 Alarm 0 Normally Closed 3 Alarm 0 Normally Open 4 GND 5 Alarm 1 Normally Closed 6 Alarm 1 Normally Open 7 Alarm 1 Common 8 GND 9 +12 @ 140 mA 10 GND 11 GND 12 Alarm 2 Normally Open 13 Alarm 2 Common 14 Alarm 2 Normally Closed
❺ *Figure 2-3* on page 2-4	DB15HD female	Video output	1 Red 2 Green 3 Blue 4 ID Bit 5 Self Test 6 Red RTN 7 Green RTN 8 Blue RTN 9 Missing Pin 10 RTN 11 Not connected 12 Not connected 13 H-Sync 14 V-Sync 15 Not connected
❻ *Figure 2-3* on page 2-4	DB9 female	Serial I/O	1 NC 2 RXD (receive data) 3 TXD (transmit data) 4 DTR (data terminal ready) 5 GDN 6 DSR (data set ready) 7 RTS (ready to send) 8 CTS (clear to send) 9 NC
❼ *Figure 2-4* on page 2-6	USB	Mouse, keyboard, barcode scanner	1 +5 V out 2 Data - 3 Data + 4 GND

Table 1: External Connectors (continued)

Reference	Connector	Description	Pinout
❽ *Figure 2-4* on page 2-6	RJ 45	Ethernet – 10/ 100BaseT	1 TD+ 2 TD- 3 RD+ 4 NC 5 NC 6 RD- Yellow LED ON = 100 Mhz OFF = 10 Mhz Green LED Link/Activity

Connector ❸, Synchronous Data Link Control (SDLC) interface, is electrically compatible with the EIA-RS485 standard. The communications protocol is derived from the IBM SDLC specification and uses its Non-Switched Multipoint Half-Duplex configuration. This interface is compatible with all Spacelabs Medical modules, Flexport interfaces, gas analyzers, telemetry receivers, and printers.

Connector ❹, alarm relay output, is compatible with third-party alarm devices that conform to the pinout shown in the alarm relay schematics (refer to *Alarm Relay* on page 2-8).

Connector ❺, video output, is a standard 15-pin, high-density, D-Sub connector. The output to the display includes H-sync and V-sync signals, allowing the use of a wide range of third-party displays.

Connector ❻, serial communications interface, conforms to the EIA-RS-232 standard. The baud rate and number of start, stop, and parity bits are software programmable. The default is 9600 baud, 1 stop bit, 8 start bits, and no parity bits.

Connector ❼, Universal Serial Bus (USB), follows the USB1.1 standard. These three ports provide power and communications for USB peripherals, such as a keyboard, mouse, and barcode scanner, that are approved by Spacelabs Medical.

Connector ❽, Ethernet, conforms to the IEEE 802.3 standard for 10/100BaseT.

External Controls

The power ON/OFF switch located on the front bezel is the only external control for the monitor.

Printed Circuit Board Assemblies (PCBAs)

CPU PCBA

Note:

Refer to the list of Assembly Drawings and Schematics on page 6-4 for the complete system block diagram.

The CPU PCBA runs the system software, updates the display, and communicates with peripheral devices through the I/O PCBA.

It has four major subsystems (*Figure 3-1*):

- Power Supply
- Core Processor, including all 64-bit peripherals
- PCI subsystem, including 32-bit peripherals
- ISA subsystem, including 16-bit peripherals

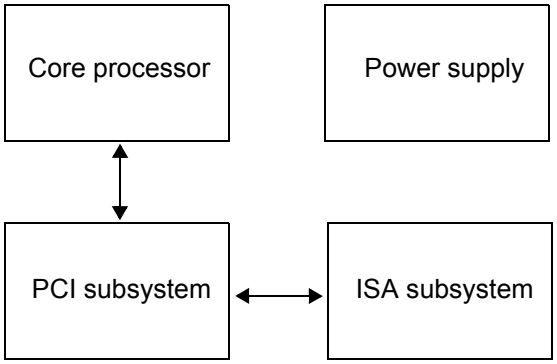


Figure 3-1: CPU PCBA setup

Power Supply Section

The power supply subsystem produces power to drive the entire system, including the CPU, display, parameter module, and battery charger (*Figure 3-2*).

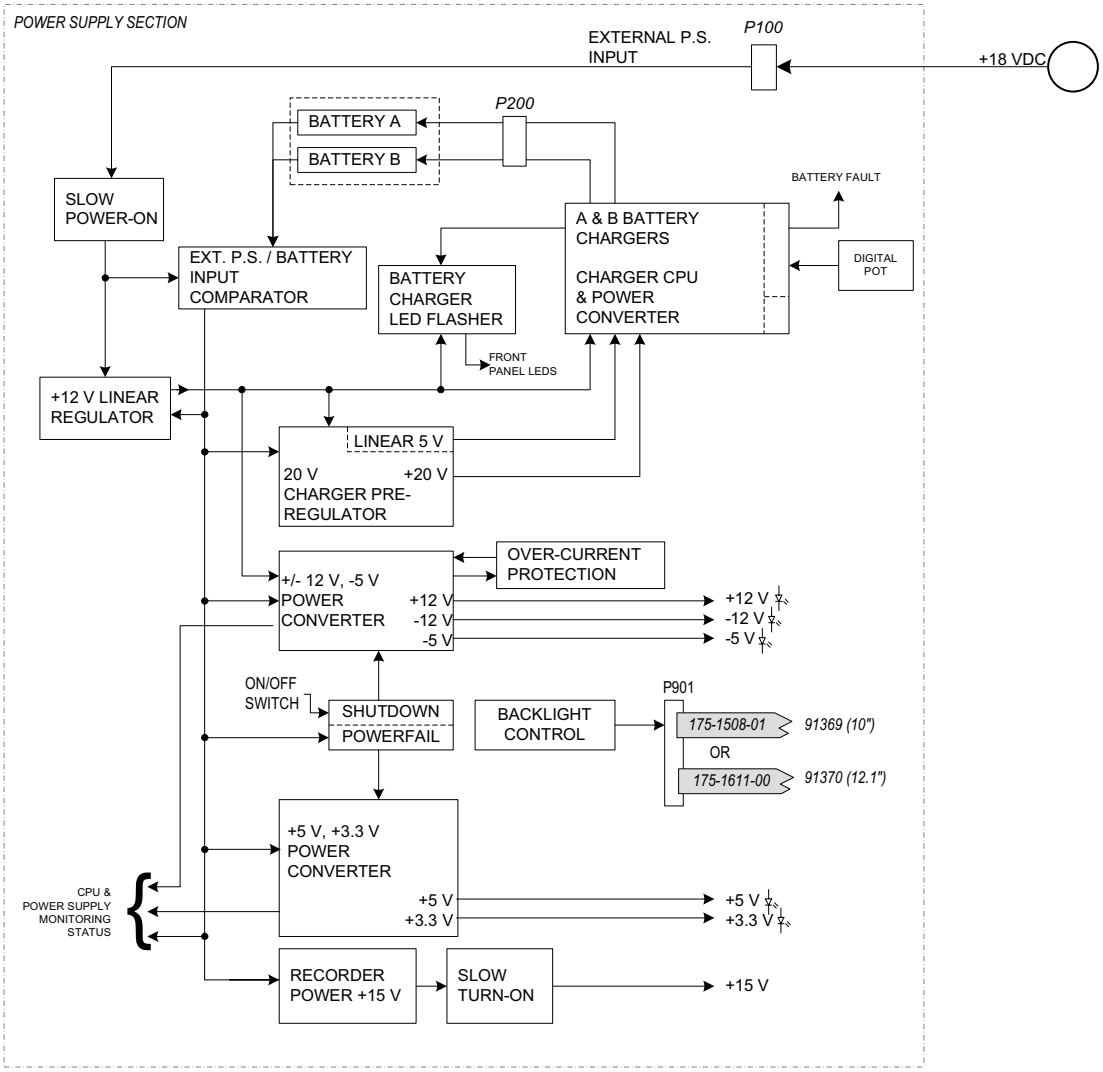


Figure 3-2: Power supply section

Power Supply Connector

Power is supplied to the monitor from an external DC power supply. Power arrives at the CPU PCBA via a single connector, P100, at 18 VDC.

DC-DC Converters

The internal power supply derives six output voltages for different functions of the CPU PCBA.

- +12 V @ 24 W
- -12 V @ 1.2 W
- -5 V @ 0.5 W
- +15 V @ 3 W
- +5 V @ 15 W
- +3.3 V @ 6 W

In the event of mains power failure, all supplies are maintained through power derived from up to two internal 12 V NiMH batteries.

The power supply subsection has a slow power-ON feature, which prevents high inrush currents when power is switched ON. The power supply will also control which input source to use, either the external power supply or the batteries. The minimum input voltage required to operate the monitor is 11.5 VDC. If the external power supply input is less than 11.5 VDC, and the batteries greater than 10.75 VDC, the monitor will run on battery power.

Power Failure Operation

The power supply on the CPU PCBA provides a digital signal PFAIL to the CPU to indicate that a power failure condition is imminent. This signal is asserted by the power supply if its input power fails, or if the monitor is switched OFF. This signal is provided through a power supervisor IC to the MPC8270 as an interrupt, causing the processor to take immediate power failure action.

Power failure operation of the monitor takes advantage of the fact that this monitor's design requires at least one charged battery to be present at all times. This battery provides power for the monitor far in excess of the intended three-minute data retention requirement for the module data.

Battery Chargers

The battery chargers have the following features:

- Front panel LED battery charging/failure indicator.
- Automatic "battery care" recharge cycles to ensure a maximum charge.
- Individual battery chargers for each of the two batteries, so that a bad battery will not degrade the other battery.
- If the monitor is OFF, one or two batteries can be fully charged in 90 to 120 minutes. If the monitor is ON, batteries are charged in four to five hours.

Charger Pre-Regulator — The +20 VDC output provides up to 60 W of battery charging power. This DC output voltage is then used as the main power source for charging batteries. The circuit uses a single-ended flyback converter topology. This pre-regulator circuit is active at all times when the monitor is powered from the external power supply voltage.

Charger CPU IC — This IC is a pre-programmed microprocessor designed specifically for controlling the charging of batteries. The CPU monitors the voltage and resistance of the batteries while charging and determines when to turn the charger power converter ON or OFF, and can detect faulty batteries. The CPU periodically performs maintenance cycles to keep batteries fully charged.

Charger Power Converter — The power converter consists of a LT1511 step-down converter and various discrete components. It is turned ON and OFF under the control of the charger CPU IC. When ON, it charges the batteries with the maximum current that is allowed by the charge rate control circuit.

Charge Rate Control — The minimum battery charge rate is always controlled by the battery itself. A battery will only accept the current it is capable of converting to charge inside the cells. However, the control for the maximum battery charge current is controlled in one of two ways. If the monitor is powered from the power supply and the front panel power switch is OFF, the maximum charge current defaults to the maximum current that the batteries can take, which is 1.8 A. If the monitor is powered from the AC/DC power supply and the front panel power switch is ON, the CPU will have control of the maximum battery charge rate via an analog switch and digital potentiometer. The CPU monitors the power consumed by the monitor electronics and adjusts the charge current based on the amount of remaining power available from the power supply.

Battery Charging LEDs — A pair of simple op-amp oscillator circuits controls the operation of the two front panel battery charge status LEDs. When either battery is charging, a signal from the charging circuit causes that battery's oscillator to run, which causes the corresponding front panel LED to flash. The two front panel battery charge status LEDs are independent of the front panel power LED. When external power is available, the power LED is constantly lit; this LED is off when external power is not available.

Battery Fault/Interrupt Signal — If the battery voltage exceeds the upper limit, the charger CPU IC will power OFF the charger and then attempt to charge again. If the battery voltage exceeds the upper limit again, a 1 Hz signal will be sent to an MPC8270 CPU interrupt input (via the ISA bridge). The software will sense this 1 Hz rate and will indicate a battery failure. If the battery voltage is too low, the process is the same.

Automatic Fan Control — The MPC8270 CPU monitors internal temperature via temperature sensors and an A/D. If the temperature exceeds a preset limit, the CPU will run the fan at a normal speed until the temperature is reduced. However, during battery charging, the battery chargers override the CPU and force the fan on at a higher than normal speed. This allows the battery chargers to run at full output without overheating the unit.

Note:

The fan will not operate unless a battery is installed.

Core Processor Subsystem

The core processor subsystem includes a memory subsystem and a microprocessor subsystem (*Figure 3-3*). The memory subsystem incorporates Flash ROM, Synchronous DRAM (SDRAM), and Static RAM on the local 60x bus. All are directly controlled by the memory controller of the MPC8270 microprocessor.

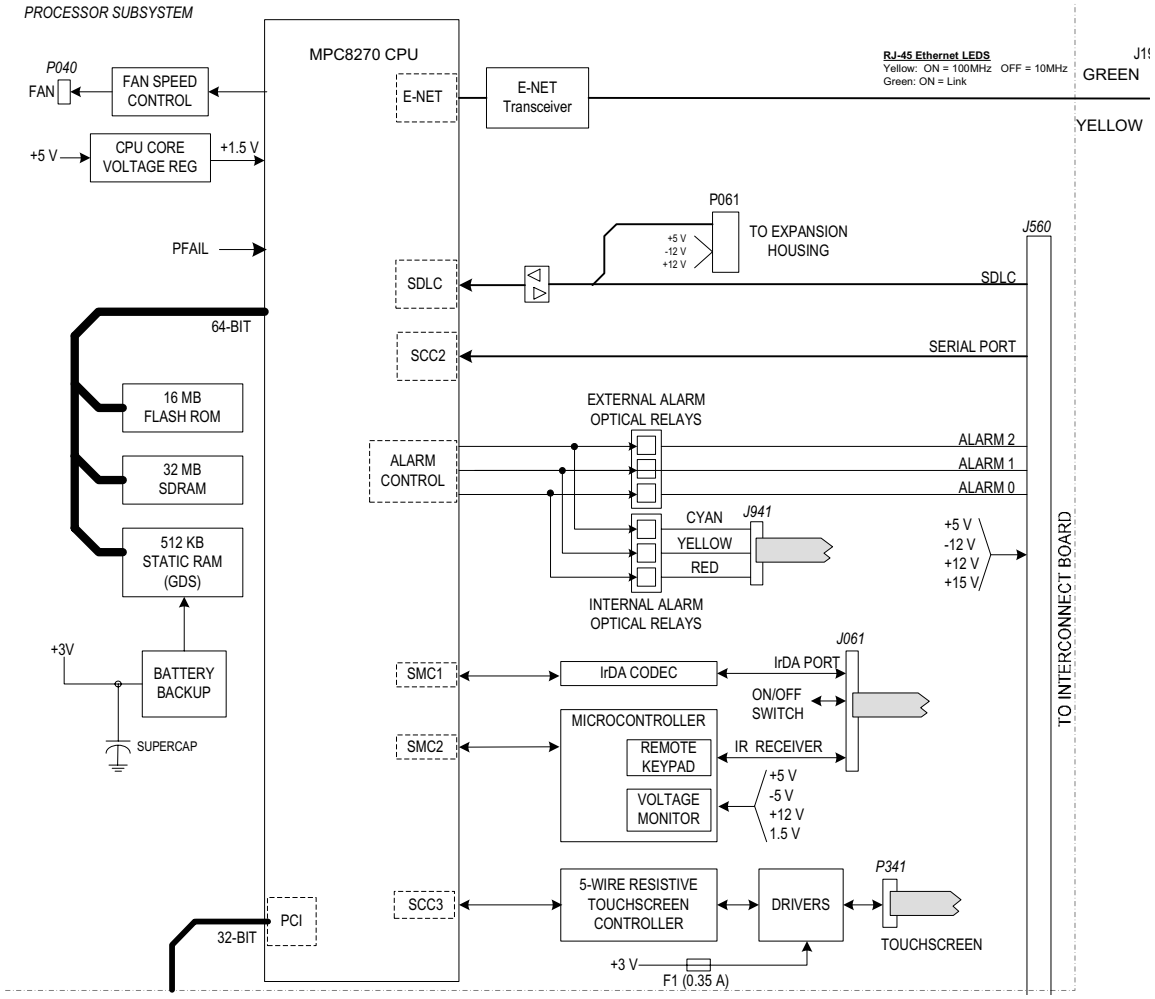


Figure 3-3: Core processor subsystem

Memory

Flash ROM Memory

The Flash ROM contains all code executed by the monitor. Refer to *Boot Sequence Overview* and *Normal Operation Overview* on page 3-18. The Flash ROM is updated via the network interface, using File Transfer Protocol (FTP).

Control over the Flash is done with the GPCM and a dedicated CS0 region, controlling the entire memory bank. Common Flash Interface (CFI) is the communication method. Two banks of Flash memory (Intel Advanced+ BootBlock C3-family, 64 Mbit, ×16, 80 ns) are used on each PCBA, providing a total of 16 MB of Flash memory.

SDRAM Memory

In Normal Operation, the CPU executes code directly from SDRAM.

The 32 MB (256 Mbits) SDRAM is refreshed using its auto-refresh mode. Using the SDRAM's periodic timer, an auto refresh command is issued to the SDRAM every 15.6 μs.

Static RAM (GDS) Memory

The Static RAM contains Patient Trend Data and Demographics, known as the Global Data System (GDS).

The monitor contains two banks of 256 KB SRAM that hold the GDS data. They draw their power from the 3 V backup with a minimum of three minutes of battery backup supply, using a SuperCap with the MAXIM 6363 supervisor.

Chip Selects

Chip selects for devices on the 60x bus are generated by the MPC8270 memory controller unit.

The monitor uses only three of the 12 available chip selects:

- **CS0** — Boot Flash (controlled by the GPCM)
- **CS2** — SDRAM (controlled by the SDRAM)
- **CS6** — GDS SRAM (controlled by the GPCM)

MPC8270 Microprocessor

The monitor uses the Motorola MPC8270ZQ processor.

Some of the special features include:

- PowerPC G2_LE core processor unit.
- Separate power supply for the internal logic (1.5 V) and for I/O (3.3 V).
- 64-bit data and 32-bit address on the 60x bus.
- 32-bit address/data on the PCI bus.
- Integrated PCI 2.2 compliant bridge, 32-bit data bus, 66 MHz, 3.3 V.
- Twelve-bank memory controller with glueless interface to SRAM, SG1DRAM, and Flash.
- Embedded 32-bit RISC architecture communication processor.

Ethernet Interface

The MPC8270 contains fast ports on its communication module. The monitor takes advantage of one FCC standard port (FCC1) for the 10/100BaseT Ethernet port. The interface to the Physical Layer (PHY) is through full Media Independent Interface (MII). Data communication is in Nibble mode (4 TX_D lines and 4 RX_D lines). The RJ-45 connector contains LEDs indicating speed (yellow ON for 100 MHz, yellow OFF for 10 MHz) and link status (green flashing about once every five seconds for Link Active).

MII

The MPC8270 has all the MII pins except bi-directional data line (MDIO) and MDC (clock), which are provided between the PHY chip and MPC8270 GPIO.

- MDIO → PC4
- MDC → PC3

Fast Ethernet PHY

An Intel LXT972A is used for Ethernet PHY. This is an IEEE-compliant Fast Ethernet PHY transceiver supporting both 10BaseT and 100BaseT applications.

SDLC Interface

The SDLC bus is the communications interface to Spacelabs Medical modules, which supply patient data to the monitors. The SDLC interface runs at 1.892352 MHz. This is divided down to generate a 448 Hz sampling rate. The SDLC communication task retrieves the data from the bus, assembles it into a packet format, and provides it to the monitor application. The SDLC clock signals are output by the SDLC interface and are used to drive the external SDLC bus and modules. The SDLC data signals are bi-directional and can be used to both transmit and receive data from the intelligent modules.

RS-232 (UART)

The RS-232 universal asynchronous receiver-transmitter (UART) uses some UART signals for communication with external devices. Linear Technology LTC1331 RS-232 transceivers are used to provide 3 V interface with the MPC8270. Communication with external RS-232 devices is through the 9-pin DSUB connector and transmission speed is limited to 9600 Kbps.

Embedded Alarm Light

A “flexible circuit” and PCBA contain circuitry for the embedded alarm light. Five ultra-bright LEDs are used for each color (red, yellow, and cyan) to generate the back light for the lens.

Because alarms are available on the monitor as well as externally, an internal signal is provided (from pin PB26 on the MPC8270), allowing the software to enable/disable the embedded alarm light on the monitor.

At initial power ON, the LEDs cycle through at a rate of 4.2 Hz for a duration of two seconds, which is more rapid than the fastest flash rate used for any alarm condition (2.8 Hz). This function allows the user to confirm that all the LEDs are functional.

Optical relays are used for both the embedded alarm light and the external alarm relay output.

External Alarm Control

During boot diagnostics, all three alarm relays are tested for two seconds. During normal operation, the high-priority alarm relay is activated during high-priority alarms (for example, heart rate), and the medium-priority alarm relay is activated during medium-priority alarms (for example, leads off).

Remote Keypad (Optional)

The monitor supports the 90360 remote keypad. The communication from the keypad is through 940 nm wavelength infrared, and processing is done in the Motorola MC68HC908 8-bit microcontroller.

Touchscreen Circuitry

An ELO Graphics Coach chip set is built into the CPU PCBA to handle all communication between the 5-wire resistive matrix touchscreen and the MPC8270 CPU. In addition to the standard UART signals, additional signals from the on-board touchscreen controller (touchscreen sense, wake up, and shutdown) are directly routed to the MPC8270 GPIOs. The current drivers for the touchscreen are sourced from +3 VDC through fuse F1.

Hardware Reset

Externally driven HRESET will cause the following:

- Initialize memory controller
- Initialize system protection logic
- Initialize interrupt controller
- Initialize parallel I/O pins

PCI Subsystem

The PCI subsystem interfaces directly to the PCI Bridge integrated into the MPC8270 processor (*Figure 3-4*). All accesses to the PCI devices are done through this bridge. The monitor supports up to five PCI devices, not including the PCI module integrated into the MPC8270. Not all devices reside on the primary PCI bus. To keep the design modular and simple, only the PCI/ISA bridge, PCI/PCI bridge, and video controller reside on the primary PCI bus. The PCMCIA controller is placed on the secondary PCI bus through the PC/PCI bridge. The USB keyboard and mouse are supported by a USB controller located within the Intel 82371, which is USB v1.1 compliant.

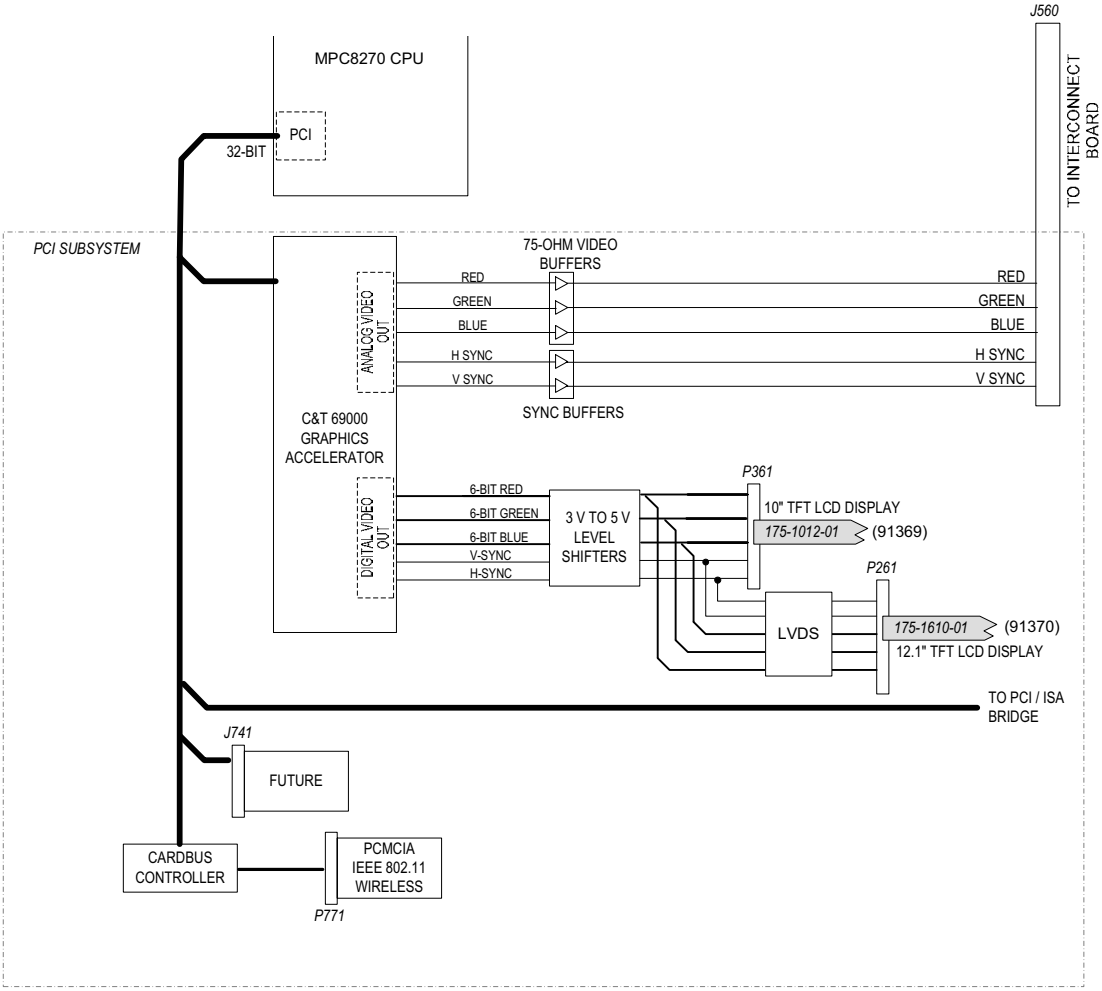


Figure 3-4: PCI subsystem

Video

Video is implemented using an Asiliant 69000 VGA controller that resides on the PCI bus. The video system uses 2 MB of internal RAM for video memory. The video controller directly generates digital video signals for the liquid crystal display. It also generates equivalent analog RGB signals, which are buffered and sent to the external VGA connector for connection to an external display. H-sync and V-sync signals are also routed to the VGA connector.

PCI/PCMCIA Controller

An internal, 68-pin, PCMCIA socket connector is standard and is the interface for a PCMCIA IEEE 802.11(a/b/g) wireless network card. A Texas Instruments PCI2250 has an OverCurrent detection output, which is fed directly to a GPIO on the MPC8270. Software can take action, if desired, on the assertion of this pin (for example, PCMCIA shutdown).

The PCMCIA controller has a direct interrupt line to the MPC8270 CPU through IRQ3.

Wireless LAN

The wireless LAN is implemented using a Symbol technologies 802.11b direct sequence spread-spectrum radio. This card is a compact flash style card interfaced to the main CPU board through a PCMCIA interface adapter. This adapter is connected to the MPC8270 CPU through a PCI1510 PC card controller. All timing is PC card/PCMCIA standard. The wireless card resides in PCI subsystem. This wireless card communicates via an embedded software driver through the VxWorks operating system. These packets contain received data or data for transmission or commands to the wireless LAN card.

PCI/ISA Bridge

An Intel 82371EB South Bridge, which is part of the Intel Chipset 440BX, is used to simplify software porting. The Bridge is the interface between the 32-bit PCI bus and the 16-bit ISA bus. The ISA bus is maintained for the support of Audio CODEC, NVRAM, and ISA wireless interface.

The Bridge also contains the USB Root Controller, which connects to and controls the 4-port USB hub.

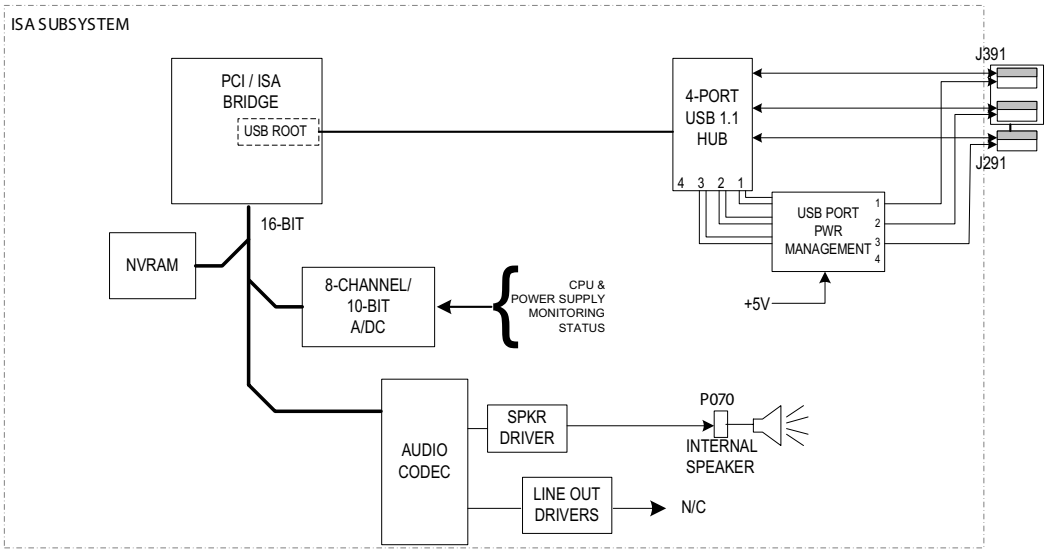


Figure 3-5: ISA subsystem

NVRAM

Non-volatile RAM (NVRAM) is used for SysGen, error logging, and time/date keeping. It is implemented with a Dallas Semiconductor DS1644 non-volatile timekeeping RAM.

It is a highly integrated device, containing the following:

- 32 K × 8 static RAM.
- Lithium battery with a 10-year life.
- Time-of-day clock with ±1 minute per month accuracy.

- Power-fail circuitry to protect the clock and RAM on power OFF.
- CMOS Static RAM: stores all Configuration Data in 32 K bytes.
  - User-defined defaults
  - Biomed- and clinical-level settings
  - Passwords
  - Sysgen Settings
  - Event Log
  - Touchscreen Calibration Data

Eight-Channel ADC

The 8-channel, 10-bit ADC is used to monitor power supply functions, including voltage and temperature.

Audio CODEC

An Analog Devices AD1845 produces the sound generation for the monitor. It drives an amplifier for the internal speaker. Line Out functionality is not currently supported.

Interconnect and Connector PCBAs

The Interconnect PCBA plugs directly into the CPU PCBA via J1 (*Figure 3-6*).

It provides power distribution and EMI filtering for:

- (Optional) Recorder
- (Optional) Recorder CPU
- SDLC (module)

The Interconnect PCBA also provides a signal pass-through to the Connector PCBA, which contains:

- Serial Port
- Analog Video
- External Alarm Relay Output
- SDLC

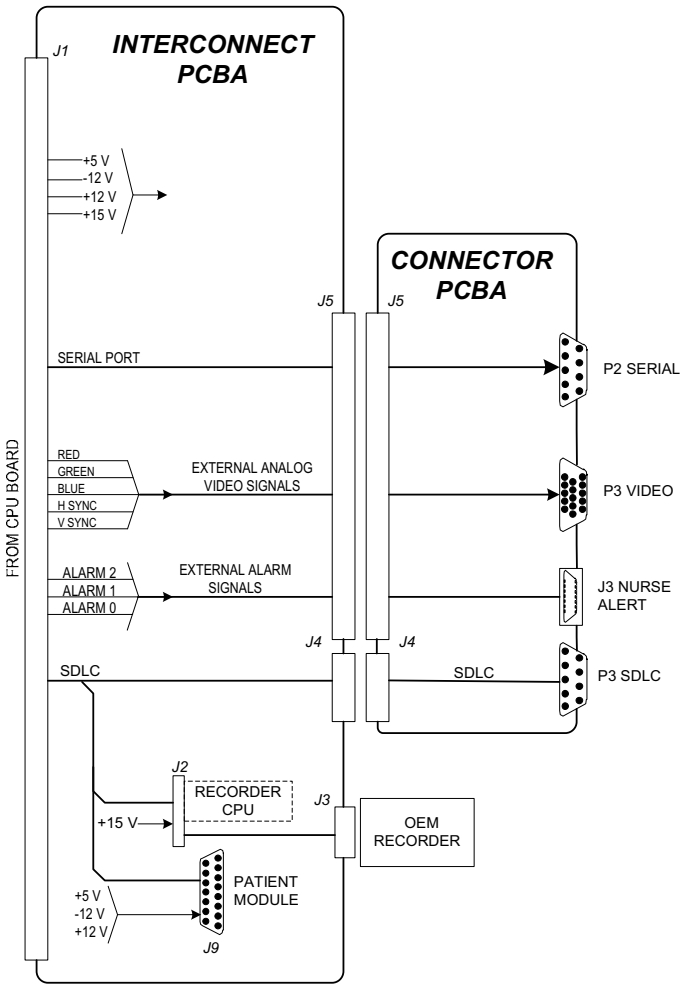


Figure 3-6: Interconnect and Connector PCBAs

Bezel Assembly

The Bezel Assembly is comprised of four items (*Figure 3-7*):

- Power indicator PCBA
  - Battery charger status LEDs
  - AC mains LED
  - Power ON/OFF switch
  - Infrared receiver
  - Direct cable connection to CPU PCBA J061 for battery status, mains connected, infrared, and power switch
- 12.1-inch TFT color LCD display

- Digital video via direct cable connection from CPU PCBA P161
- Backlight power converter
- Backlight

• 5-wire resistive touchscreen
- Elo Touchsystems E271-2210 compatible
- Direct cable connection to P341 on CPU PCBA

• Embedded alarm light assembly
- Direct cable connection to P941 on CPU PCBA
- Three banks of LEDs: cyan, yellow and red.

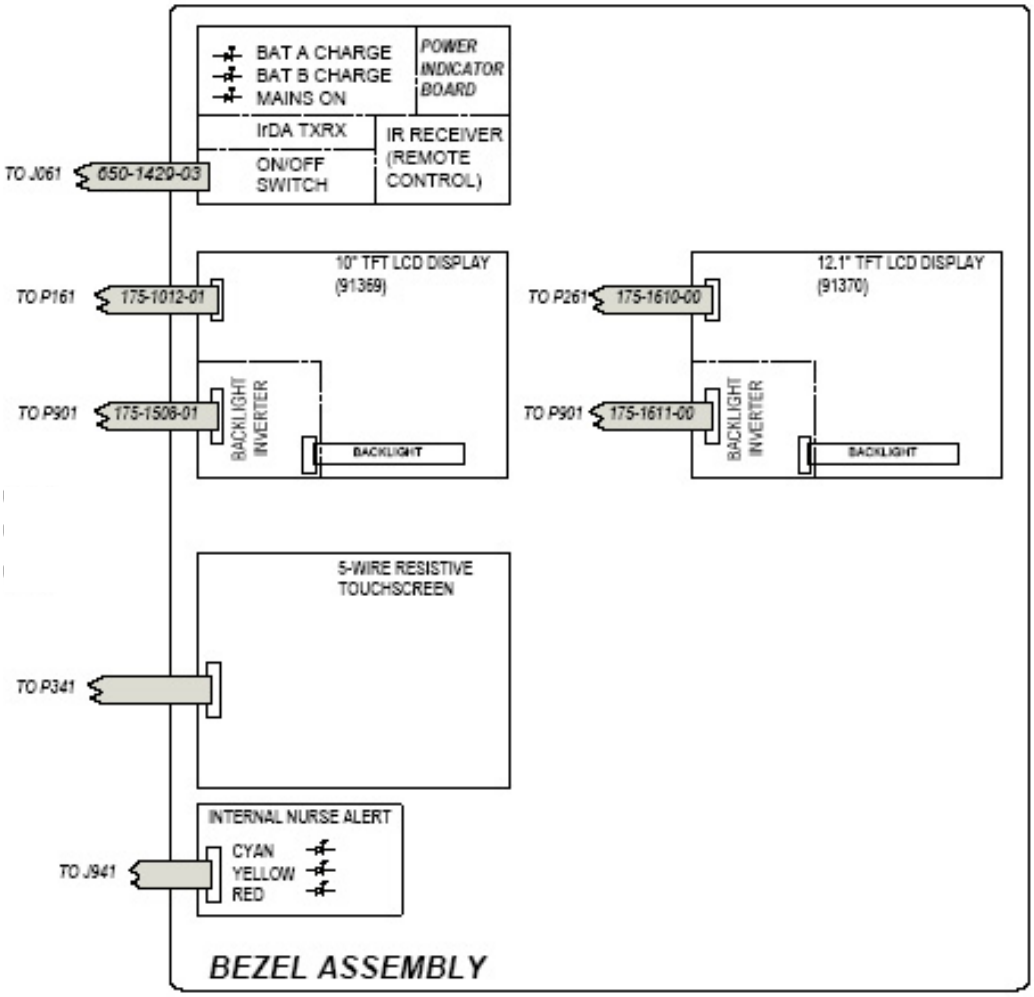


Figure 3-7: Bezel assembly

Boot Sequence Overview

When power is applied, the monitor begins its boot-up sequence. The following is a highly abbreviated version of the sequence of events that occurs while the monitor is booting.

1 Program execution starts in Flash ROM.

2 Key internal and external devices and memories are mapped and enabled.

3 The boot-type value is read from Static RAM. This value is written to Static RAM, which is backed up by a "SuperCap," at every power-down or self-reboot. The value determines the kind of boot: warm or cold. Warm booting maintains all data, then skips diagnostics and other steps in order to restore monitoring as soon as possible.

4 Key areas of SDRAM are tested (cold boot only).

5 The boot code is copied from Flash ROM to SDRAM, where program execution resumes.

6 More internal and external devices are initialized.

7 Other key memory and CPU tests are performed (cold boot only).

8 Drivers needed for diagnostics and the boot console are installed.

9 Diagnostics are run (cold boot only).

10 Boot screen and the "3-2-1" countdown are displayed (cold boot only).

11 The VxWorks kernel and the application code are copied from Flash ROM to SDRAM, where program execution continues.

12 The VxWorks kernel is started, and all internal and external devices are reinstalled and initialized.

13 The monitor application code is started, and normal monitor operation begins.

Normal Operation Overview

This is a high-level summary of what the software does as part of its normal operation.

Once the monitor is booted, it begins normal monitor operation. Normal operation can be viewed as several high-level software and subsystem tasks running simultaneously. These interface to other tasks, and all the tasks interface to hardware devices via device drivers.

Main Subsystems and Tasks

The SDLC subsystem sends packets from the modules to the rest of the system, including Ethernet and GDS, and it also sends packets to modules.

The Interpreter subsystem provides modules and keys with "primitives" that they use, via table code, to create and control their user interface on the monitor. The Keys subsystem handles touchscreen key presses. It receives key presses from the user and notifies the keyboard interpreter, which then runs the appropriate table code program. That program uses the key display task to redraw the new key state as feedback to the user.

The Global Data System (GDS) is the patient database with parameter data from the modules. It contains current, general, trend, and waveform data.

The Remote Interface system handles Ethernet connections to remote monitors and modules.

It also:

- Broadcasts the existence and configuration of network devices to each other.
- Allows remote parameter attaches and remote key press connections across the network.
- Downloads the module table code to remote monitors to create the same user interface on multiple monitors.
- Supports the Alarm Watch and Remote View functions.
- Handles multicast waveform data.

The Recorder subsystem controls local and network printers.

The Alarm subsystem handles the standard alarms. Modules send alarm conditions over SDLC and, in response, the alarm subsystem sends alarm messages to the tone, display, record, and network tasks. It receives messages from the network for Alarm Watch alarms and from SDLC tasks for module/channel adds or deletes.

Display

The internal display is a 640 × 480, active matrix, thin-film-transistor (TFT) color Liquid Crystal Display (LCD). It receives 18 data signals, 4 timing signals, +5 V and ground. Backlight voltage is produced via an attached 1000 VAC inverter.

The pinout of the display connector (at the display) is provided in *Table 2*. The backlight is connected via a separate 3-pin connector

Table 2: Display Connector Pinouts on CPU PCBA P161

Pin Number	Symbol	Description
1	GND	
2	CLK	
3	HSYNC	Horizontal Sync
4	VSYNC	Vertical Sync
5	GND	
6	R0	Red Data LSB
7	R1	
8	R2	
9	R3	
10	R4	
11	R5	Red Data MSB

Table 2: Display Connector Pinouts on CPU PCBA P161 (continued)

Pin Number	Symbol	Description
12	GND	
13	G0	Green Data LSB
14	G1	
15	G2	
16	G3	
17	G4	
18	G5	Green Data MSB
19	GND	
20	B0	Blue Data LSB
21	B1	
22	B2	
23	B3	
24	B4	
25	B5	Blue Data MSB
26	GND	
27	ENAB	Settle the horizontal display position
28	VCC	+5 V
29	VCC	+5 V
30	R/L	Horizontal display mode select
31	U/D	Vertical display mode select

Parameter Modules

Any single-high Spacelabs Medical parameter module can be inserted into the module slot of the monitor.

The module receives +5 VDC, +12 VDC, and -12 VDC power from the monitor and communicates with the monitor via an SDLC data bus. In the most general terms, the module initially downloads a program (“table code”) into the monitor over the SDLC bus. This enables the monitor to interpret messages from/to the module. The module sends events and data to the monitor, which typically cause the monitor to display waveforms, keys, etc. The monitor also responds to key presses of the module’s keys, which causes various actions to occur, such as changing the way data is displayed.

For more information on the SDLC data bus, refer to *SDLC Interface* on page 3-11.

The theory of operation of a particular module can be found in that module’s service manual.

CPU PCBA Connectors

Table 3 provides a summary of all CPU PCBA connectors.

Table 3: CPU PCBA Connectors

Reference	Connector Type	Description
J191	RJ45/external	Ethernet connector
J291	USB (single)/external	Keyboard/mouse/standard USB
J391	USB (dual)/external	Keyboard/mouse/standard USB
J560	80-pin/internal	Interconnect PCBA
J941	0.1 ctr 10-pin/internal	Alarm connector
P590	2 × 5 header/internal	USB header
P710	0.1 ctr 10-pin/internal	Jtag port
P960	2 × 8 header	Development Port

CPU PCBA Jumpers

The CPU PCBA also has several jumpers for various configuration and testing purposes. These are summarized in *Table 4*.

Table 4: CPU PCBA Jumpers

Reference	Description	Default	Configuration	Comments
P040	Fan	Open		No jumper
P100	Power input	Open		No jumper
P200	Battery connector	Open		No jumper
P250	Display voltage	1-2	1-2 — Color TFT/EL 2-3 — Color TFT Open	5 V display 3 V display Display disabled
P410	Battery charger debug	1-2	1-2 — Normal operation	
P412		Open	2-3 — Debug mode Open	Charger OFF
P590	Onboard USB	Open		Not used, no jumper
P710	PLD programming header			JTAG programming
P750	CPU reset configuration	1-2	1-2 — Initial PCBA code loading 2-3 — Normal operation	Pulls RSTCONF# high Pulls RSTCONF# low
P990	SuperCap discharge	Open	Open — Normal operation Closed — Discharges SuperCap	

I/O PCBA Connectors

Table 5: I/O PCBA Connectors

Reference	Connector Type	Description	Internal/External
P1	9-pin D	SDLC	External
P2	DB9	RS-232 serial interface	External
P3	DB15HD	Video output	External
J3	14-pin D	Alarm relay	External

Interconnect PCBA Connectors

Table 6: Interconnect PCBA Connectors

Reference	Connector Type	Description	Internal/External
J1	80-pin	CPU PCBA	Internal
J2	30-pin	RCU PCBA	Internal
J3	50-pin	Recorder	Internal
J4	SDLC	INTFC to CPU	Internal
J5	Misc. signals	INTFC to CPU	Internal
J6	Ethernet	INTFC to CPU	Internal
J9	15-pin	SDLC	Internal

Maintenance

Contents

Overview

The following information describes the requirements and tests necessary for safety and performance verification of the monitor.

Caution:

Observe precautions for handling electrostatic-sensitive devices!

Note:

- *Never touch electrostatic-sensitive electronic components without following proper anti-static procedures, including the use of an ESD wrist band and mat. An electrostatic discharge from your fingers can permanently damage electronic components and cause latent failures.*
- *All static-sensitive electronic components are packaged in static-shielding bags. Retain the bag for repackaging the component should you need to store it or return it to Spacelabs Medical for any reason.*
- *Cleaning, preventive maintenance, and safety checks should be performed annually and following any product disassembly/assembly. Preventive maintenance and safety checks must be performed by trained personnel only.*

Required Test Equipment

- Electrical Safety Analyzer — Dynatech Nevada 232C or equivalent
- Patient Simulator — Dynatech Nevada 300B or equivalent

Note:

- *Before testing, ensure that the module housing(s) and its DC power supply(s) have their associated cables attached, but are not interconnected.*
- *Ensure that the Ethernet cable and AC power sources are removed.*
- *The AC line is auto detected; no user selection is necessary.*
- *Ensure that the leakage test equipment is calibrated.*

Mechanical Inspection

Verify that:

- The monitor and all optional equipment are clean.
- All screws are tight.
- The case and connector pins are not damaged.
- There are no frayed or pinched wires or cables.

Electrical Safety Testing

Safety testing protects the patient from electrical shock, especially micro-shock. It has been determined experimentally that current values in the microampere (μA) range may cause fatal arrhythmias in electrically susceptible patients. A patient is deemed electrically susceptible when connected to monitoring equipment.

Definitions

Classification — IEC/EN/UL 60601-1 Safety standard designation for the class of equipment and type of patient applied parts that indicate the degree of protection provided against electrical shock.

Leakage Current — Current that is not functional. It includes patient leakage, ground leakage, and enclosure (or chassis) leakage.

Patient Lead Leakage — Current that flows from the applied part of the patient lead to ground.

Chassis Leakage — Current flowing from the enclosure (or from conductive parts accessible to the operator) through the ground conductor.

Normal Condition — Condition in which all means provided for protection are intact. Includes, ground connections, insulation, creepage and clearance distances.

Single Fault Condition — Open ground, open neutral, line voltage on a patient connection, or any single state other than normal condition that could compromise patient safety.

UUT — Unit Under Test.

Spacelabs Medical does not endorse standards to the exclusion of others. Therefore: **BE SURE TO CHECK YOUR LOCAL REQUIREMENTS TO ENSURE YOUR EQUIPMENT SAFETY TESTS COMPLY WITH LOCAL STANDARDS**. Generally accepted standards for medical monitoring equipment, such as the Underwriters Laboratory (UL) and the National Fire Protection Association (NFPA) standards, are summarized in *Table 1*.

Table 1: Summary of Standards for Medical Monitoring Equipment

International Mains to Chassis Leakage	U.S. (120 V) Mains to Chassis Leakage	Mains Resistance
100 μA - normal condition, ground attached (AC connector to chassis)	300 μA - normal condition, ground attached (AC connector to chassis)	500 milliohms*
500 μA - single fault condition, open ground or reverse polarity	300 μA - single fault condition, open ground or reverse polarity	500 milliohms*
** Measured from the AC Power cord third wire ground to the most distant ground attachment*		

Equipment Required

Electrical Safety Analyzer, Fluke model 232D or equivalent.

These tests should be performed according to the hospital's scheduling requirements, at least annually or after repair or modification.

Warning:

Before starting safety tests, ensure that no patient is connected to the device under test. If safety tests must be performed on equipment currently monitoring a patient, obtain permission to disconnect the cables from the monitor and patient.

Note:

All tests must be performed according to the safety analyzer's operations manual, and any local requirements.

Ground Resistance

1 Attach the power cord to the monitor under test, then measure the resistance from the AC power cord third wire ground to a chassis location, such as the equipotential post on the rear of the monitor.

2 Verify that the resistance is less than 500 milliohms (0.5 ohms).

Chassis Leakage Current Tests

1 Plug the leakage analyzers into mains power.

2 Plug the equipment into the analyzer's AC receptacle.

3 Verify that the leakage current from the chassis to ground is less than the values in *Table 2*.

Table 2: Enclosure Leakage Test Conditions and Limits

Neutral Condition	Ground Condition	Polarity	International Limit	U.S. Limit
Closed neutral	Closed ground	Normal polarity	100 μA	300 μA
Open neutral	Open ground	Normal polarity	500 μA	300 μA
Closed neutral	Open ground	Normal polarity	500 μA	300 μA

Patient Lead Leakage Current Tests (Patient Modules)

Refer to the service manual of the specific module(s) you are using for patient lead leakage test instructions.

Preventive Maintenance

A Spacelabs Medical Field Service Engineer or qualified hospital biomedical technician should check the monitor and optional equipment for acceptable performance and electrical safety to ensure they operate according to current requirements.

Touchscreen Calibration

In the event the touchscreen becomes difficult to use or a replacement has been installed, you may need to calibrate it. This can be performed using the calibration function in the **Biomed** menu.

To perform the calibration, attach a mouse (in the event the touchscreen is unusable) and perform the following:

1. Power ON the monitor with the mouse attached and wait for the monitor to pass the self tests.
2. Click (or touch) the MONITOR SETUP key and then click (or touch) the PRIVILEGED ACCESS key.
3. Enter the Biomed password (default is **Biomed**).
4. Click (touch) MONITOR CALIBRATION.
5. Click (touch) TOUCHSCREEN CALIBRATION and wait for the **Reset Monitor** dialog box to display. Click (touch) the RESET MONITOR key. The monitor will reset.
6. After 15 to 20 seconds, a lighted box will appear in the upper left corner of the screen. Touch the lighted box for one or two seconds until it disappears.
7. Two more lighted boxes will appear, one at a time, in the upper right and lower right corners. Touch them as they appear.
8. After touching these three corners one at a time as the boxes appear, the touchscreen is calibrated.

Functional Tests

Monitor Self-Test

A power-ON self-test is performed each time the monitor is turned ON.

- The power ON/OFF switch (refer to *Figure 2-1* on page 2-2) illuminates indicating +5 V is present.
- If the monitor is operating on external AC power, the power LED on the front bezel also illuminates.
- If the monitor is operating on AC power and batteries are being charged, the battery A and battery B status LEDs on the front bezel flash ON and OFF at a constant rate. Once the batteries are fully charged, these LEDs remain ON. If no battery is present, one or both of the battery status LEDs will remain OFF.

Monitor Functional Tests

This procedure verifies operation of the recorder assembly, network connectivity, alarm relay output, and external SDLC connections. It assumes that a 91496 multiparameter module (ECG, RESP, two PRESS channels, and two TEMP channels) is available for testing purposes. In the event that these parameters are not available, similar modules may be substituted.

Verifying Monitor Functions

Note:

To begin the test, make sure no modules are inserted and no Flexports or other SDLC devices are connected.

1 Plug in the monitor and verify that the front bezel power LED is lit. If one or two batteries are installed, verify that the appropriate battery LED(s) are ON solid or flashing.

2 Press the power ON/OFF switch to power ON the monitor and verify the following sequence of events:

   a The power ON/OFF switch illuminates.

   b The embedded alarm light LEDs illuminate briefly. Verify that all LEDs are functional.

   c The **Diagnostic** menu displays. (If errors are noted during power ON, contact your Spacelabs Medical Field Service Engineer.)

   d If batteries are installed, the fan begins operating within 60 seconds after turning ON the monitor. The fan will then turn OFF unless the internal temperature requires additional cooling by the fan.

   e Monitor keys display along the right side of the screen.

3 Insert the ECG module without a patient cable connected. Verify that the ECG parameter key appears on the screen with **???** and the message LEADS OFF.

4 Connect a patient simulator to the ECG input with a patient cable. Set the simulator to a known rate and verify that the ECG count and the lead being monitored are displayed to the right of the ECG parameter key. Also verify that the ECG waveform appears on the screen.

5 Connect a patient simulator to the invasive pressure inputs.

6 Zero the pressures and verify that the numerics and waveforms are accurate.

Optional Recorder Assembly

If the monitor is configured with the optional recorder assembly, verify that the monitor initiates a recording by touching the RECORD key and then touching one of the flashing parameter keys.

Note:

The printed waveform should be free from defects such as gaps, extra lines, etc. If not, notify a Spacelabs Medical Field Service Engineer for servicing, or replace the recorder (refer to Recorder on page 5-19).

Alarm Relay Output

If the monitor is configured to use the alarm relay output to interface to an external alarm device:

1 Plug the cable into the external alarm connector and initiate a high-priority alarm. Verify that the external alarm responds appropriately.

2 If an external alarm light capable of displaying multiple colors is attached, turn the high-priority alarm OFF and generate a medium-priority alarm. Verify that the external alarm responds appropriately.

3 Repeat step 2 for a low-priority alarm.

An alternate method is to connect the cable and turn the monitor ON and then OFF. Each color of the embedded alarm light will momentarily illuminate. An external alarm light will also briefly illuminate.

Ethernet (Wired)

1 Attach a 10/100BaseT cable from an active network onto the side panel connector.

2 Touch the SPECIAL FUNCTIONS key and verify that other monitors appear in the **Remote View** menu.

Assembly/Disassembly Procedures

Caution:

Before beginning any disassembly procedures, power OFF the monitor, disconnect the AC cord from the AC power receptacle, and remove the batteries.

Note:

The external power supply is not designed for disassembly.

Required Tools and Parts

- Anti-static mat with wrist strap
- #1 and #2 Phillips-head screwdriver
- 5/16-inch nut driver
- 3/16-inch nut driver

Setup for Disassembly

1 Remove the external power supply cable and battery(ies) if present.

2 Remove the patient parameter module.

Installing or Replacing the Optional Recorder Assembly

Note:

Unless purchased separately for a monitor already in the field, the recorder option is installed at the factory. Order an upgrade from your local Sales Representative.

The recorder option consists of two components: the recorder module and the recorder CPU PCBA.

The recorder CPU PCBA and recorder module fit into the upper slot on the monitor's left side (refer to *Figure 4-1*). The recorder CPU PCBA must be installed first, followed by the recorder module. Refer to *Table 1* on page 6-1 for the recorder CPU and recorder assembly part numbers.

Installing the Recorder

Warning:

A safety hazard is created if the mylar insulator is not properly installed over the recorder CPU PCBA.

1 Power OFF the monitor.

2 Remove the printer "dummy panel" by removing the screw located in the top portion of the battery compartment.

3 Remove the recorder hold cover and insert the recorder CPU into the connector located at the bottom of the recorder compartment.

4 Tighten the thumbscrew to secure it to the bottom of the recorder compartment after fully inserting the PCBA into the connector.

5 Install the insulator sheet between the bottom of the printer and newly installed recorder CPU PCBA.

6 Insert the recorder assembly, ensuring that it fully engages the connector at the back of the recorder compartment. Press the release bar to open the recorder assembly and tighten the two phillips-head screws located at the rear of the recorder.

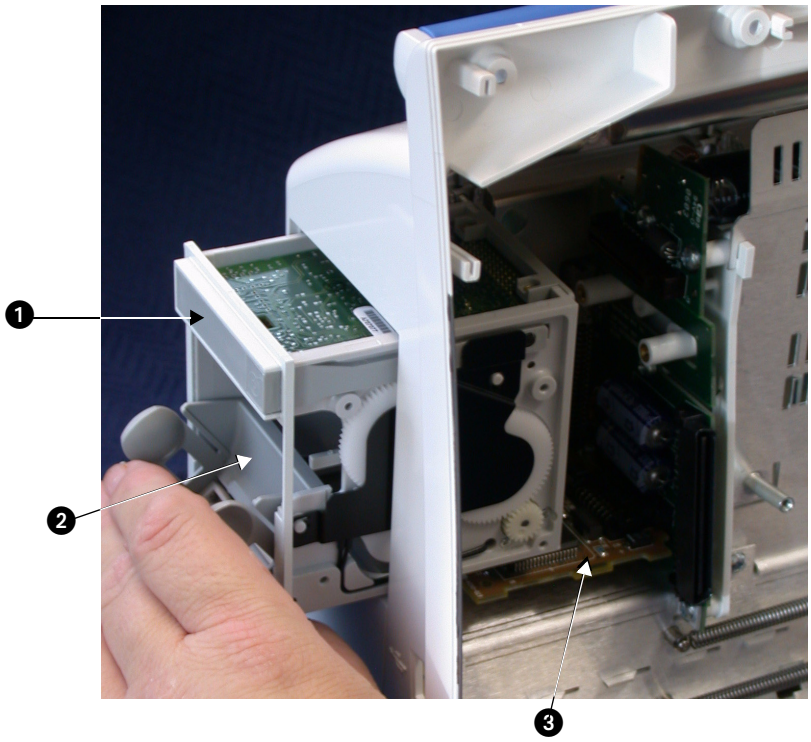


Figure 4-1: Recorder assembly and CPU PCBA

1. Release bar
2. Recorder assembly
3. Recorder CPU PCBA, installed

Replacing the Recorder

1 Remove the recorder assembly (if installed) by first opening the printer door, loosening the two captive screws, and then pulling out the assembly at the top.

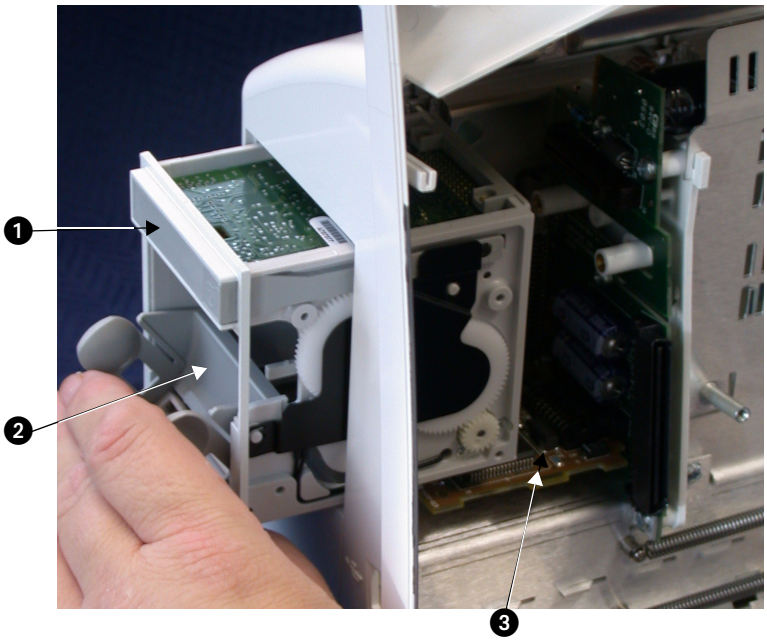


Figure 4-2: Optional recorder assembly

1. Release bar
2. Recorder assembly
3. Recorder CPU PCBA, installed

2 If replacing the recorder CPU PCBA, loosen the thumbscrew and pull it forward until it is free of the connector.

Figure 4-3: Recorder CPU PCBA

3 Reverse the procedure to re-assemble the recorder.

Inserting Recorder Paper

Two rolls of thermal recorder paper have been included with the optional recorder assembly.

To insert a roll of paper:

1 Press the right side of the release bar at the top of the recorder assembly. The front of the recorder assembly is hinged at the bottom and will drop open, revealing two spoon-shaped arms that hold the paper roll spindle between them.

2 Unroll a short length of paper from the roll, and orient the roll so that the paper feeds from the bottom.

3 Slip the paper roll spindle between the plastic arms, and close the front of the assembly so that the end of the paper roll protrudes out of the recorder assembly just below the release bar.

Removing the Bezel Assembly

1 Remove the bezel by removing the five screws along the bottom of the enclosure, and then stand the monitor upright and remove the four screws along the top of the bezel.

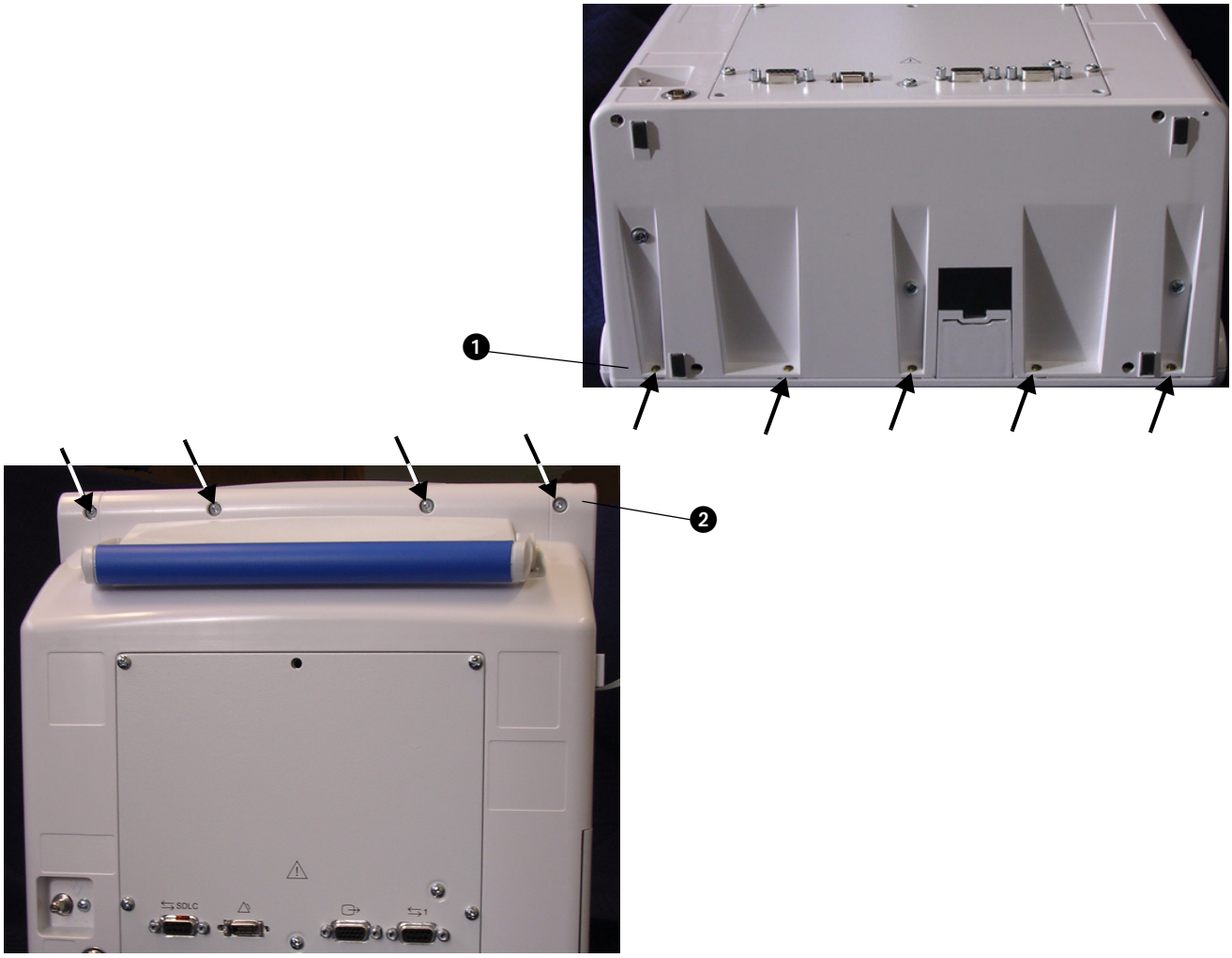


Figure 4-4: Bezel screw locations

1 Five screws along the bottom of the bezel

2 Four screws along the top of the bezel

2 With the monitor standing upright, gently move the top of the bezel and disconnect the flat cable running from the display to the CPU PCBA.

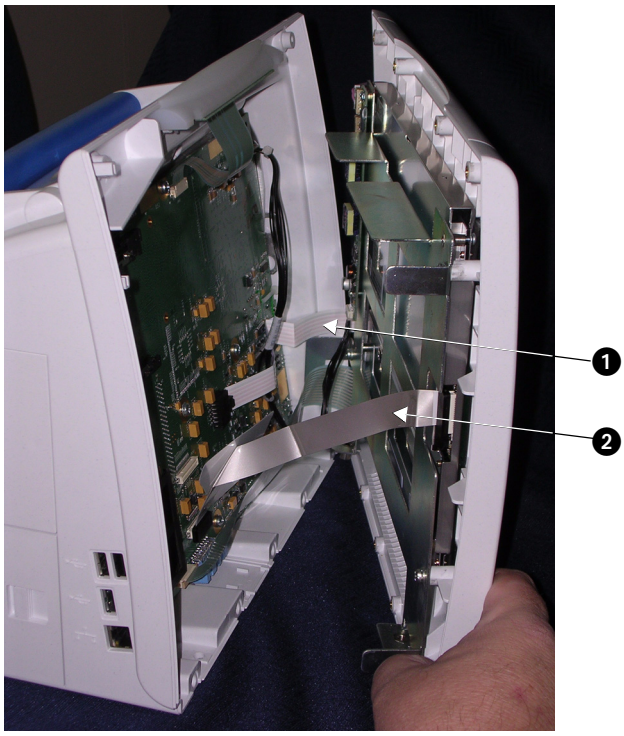


Figure 4-5: Removal of the front bezel

1. Front panel power/LEDs cable
2. Video cable

Caution:

- **Never pull on the flex cable. This may damage the cable end or the connector.**
- **Take care when handling cables and connectors. They are fragile and can be damaged.**

Note:

- *Due to the short length of the video cable, remove it prior to fully opening the case.*
- *Proper operation of the monitor depends upon correct cable re-insertion following disassembly. Ensure that the flex cable is aligned properly and fully inserted into the connector prior to locking the connector tab down.*

3 Remove the touchscreen five-wire cable from the CPU PCBA.

4 Remove the power switch/monitor assembly by sliding the “ZIF” connector locking mechanism outward, then removing the cable from the socket.

5 Unlatch the touchscreen cable and remove the eight 6-32-inch × 1/4-inch screws (three along the top, three in the center, and two at the bottom of the PCBA).

If you are replacing the front bezel, proceed to the next section (*Replacing the Display or Touchscreen Assembly, Backlight Inverter, and Power Monitor Assemblies*) for removal of the remaining front bezel assembly components.

Replacing the Display or Touchscreen Assembly, Backlight Inverter, and Power Monitor Assemblies

1 Remove the front bezel assembly as described in *Removing the Bezel Assembly* on page 4-11.

2 Remove the four screws securing the display assembly to the front bezel and carefully lift the assembly from the bezel.

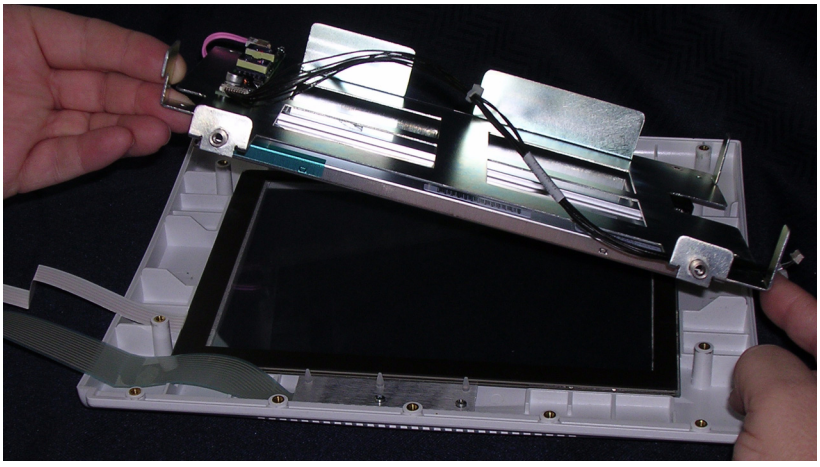


Figure 4-6: Removing the touchscreen display bracket

Caution:

The glass touchscreen may stick to the front of the display bracket. Do not allow it to fall off of the bracket during removal.

3 Remove the four screws securing the display to the brackets.

Note:

Be careful not to leave finger prints or smudges on the front of the display or on the inside of the front bezel surface.

4 Reassemble the bezel assembly. Pay close attention to placement of the touchscreen, assuring that it is placed within the raised portion of the bezel prior to securing the display assembly. If alignment is not correct, the touchscreen can be permanently damaged.

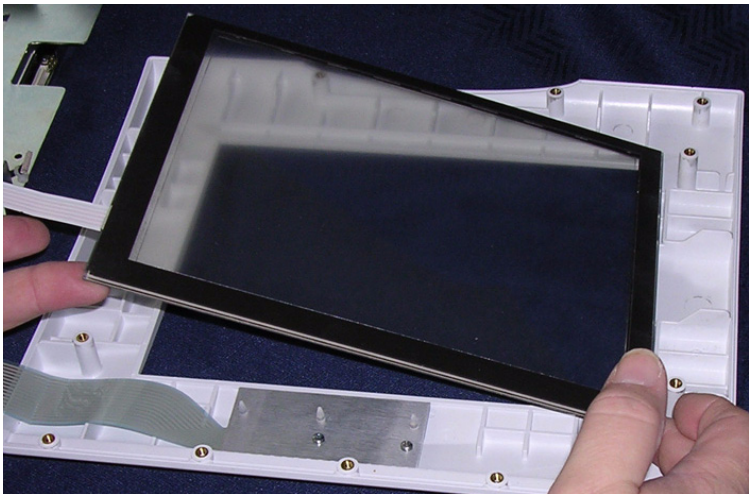


Figure 4-7: Touchscreen placement

5 To remove the backlight inverter, remove both cable assemblies and the two screws attaching the inverter to the display bracket.

6 When replacing the backlight inverter, be sure to replace the mylar shield (*Figure 4-8*) between the PCBA and the chassis.

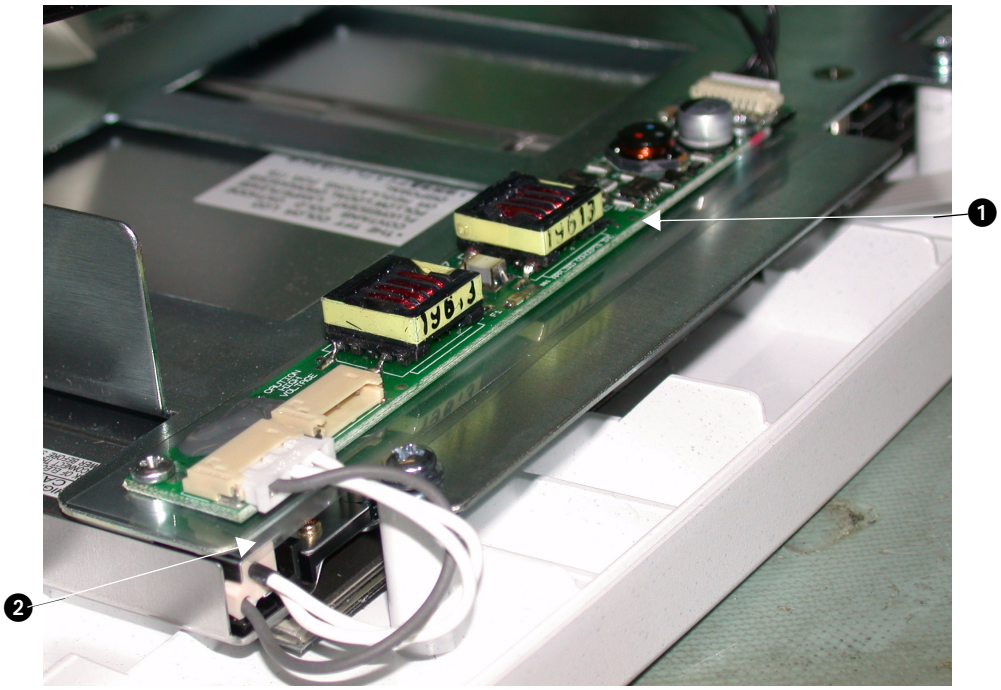


Figure 4-8: Backlight inverter

1. Backlight inverter
2. Mylar shield

Replacing the Connector PCBA

Removing the Rear Panel

1 Remove the five 6/32-inch × 1/2-inch screws.

Figure 4-9: Rear panel replacement

2 Remove the two 10/32-inch × 1/2-inch screws.

3 Carefully remove the rear panel and set it aside for further disassembly.

Removing the Connector PCBA

1 Remove the six 3/16-inch jack screws that secure the SDLC, video, and RS-232 connectors.

2 Remove the two 6/32-inch × 1/4-inch screws that secure the SDLC PCBA to the rear panel.

3 Reinstall the replacement connector PCBA in reverse order.

Replacing the CPU PCBA

1 Remove the batteries, if present.

2 Remove the bezel (refer to *Removing the Bezel Assembly* on page 4-11).

3 Remove the nine screws that hold the CPU PCBA to the chassis (refer to *Figure 4-10*).

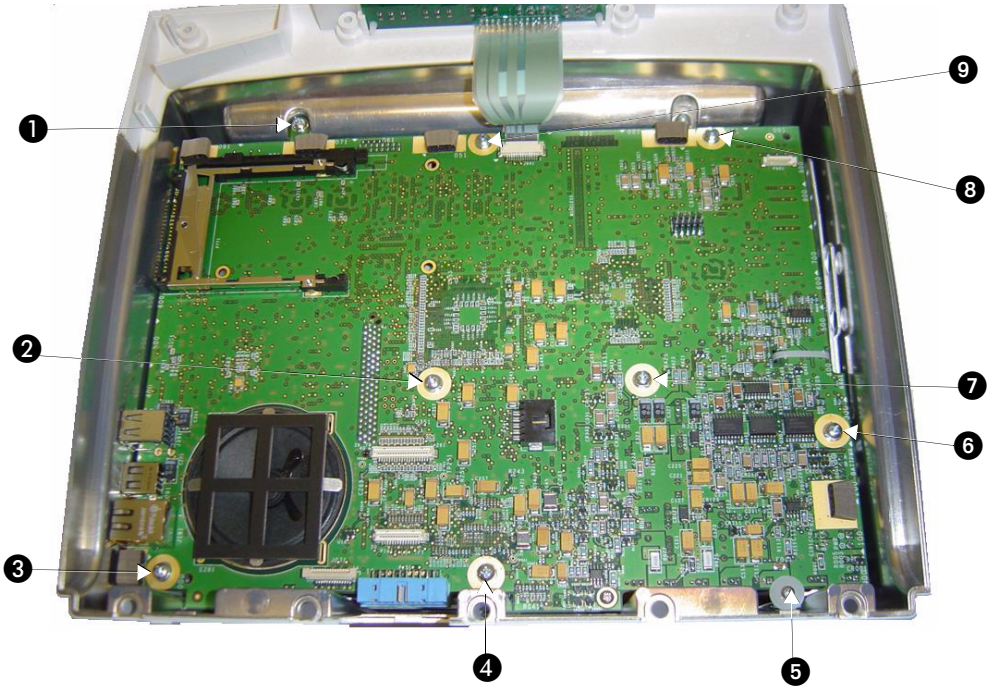


Figure 4-10: Nine screws holding the CPU PCBA to the chassis

4 Place your fingers into the space on either side of the upward protrusion of the CPU PCBA (located near the two top mounting screws) and pull. This will free the CPU PCBA-to-Interconnect PCBA connection.

5 Pull the CPU PCBA from the top carefully until the cables along the bottom of the assembly are visible.

6 Disconnect the three cables and set the CPU PCBA into a static-protected area.

7 Reinstall the replacement CPU PCBA in reverse order.

Replacing the Wireless Radio Card

If the monitor is equipped with optional wireless functionality (option Z), refer to the following instructions if radio card replacement is necessary.

To remove the wireless radio card:

1 Remove the batteries, if present.

2 Remove the bezel (refer to *Removing the Bezel Assembly* on page 4-11).

3 Hold the PCMCIA card adapter in place and press the eject bar (❶). The radio card (❷) releases from adapter. Remove the card and detach the antennas.

Figure 4-11: Radio card released from the PCMCIA card adapter

To install the wireless radio card:

1 Remove the replacement radio card (P/N 010-1644-xx) from the packaging.

2 Reattach the antennas (refer to *Figure 4-12*).

Caution:

Be very careful to properly align the antenna connector and the receptacle before applying pressure to mate the two.

If the connector cannot be seated using finger pressure, use the blunt end of a small tool (such as a 5/32-inch hex wrench) to apply pressure to the connector.

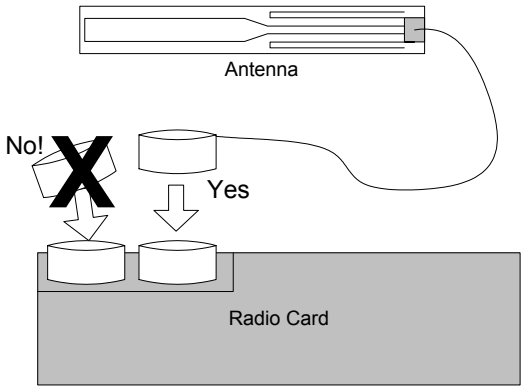


Figure 4-12: Antenna connection to the radio card.

3 Insert the radio card into the Compact Flash card adapter on the main CPU PCBA. When the card is fully seated in the Compact Flash card adapter, the card eject bar (❶) extends. Refer to *Figure 4-13*.

Figure 4-13: Radio card fully seated into the PCMCIA card adapter

Replacing the Radio Card Antennas

1 Remove the radio card as described in *Replacing the Wireless Radio Card* on page 4-17.

2 Detach the antennas from the radio card.

3 Detach the antennas from the side bezel of the monitor. Use a thin bladed knife, if necessary, to remove any remaining foam tape adhesive.

4 Remove the replacement antennas (P/N 117-0165-xx) from their packaging.

5 Carefully connect the two antennas by inserting the antenna connectors into the micro-coaxial connector receptacles on the radio card (either antenna can be connected to either connector). Ensure that the connector and the receptacle in the radio card are properly aligned before applying pressure to connect them (refer to *Figure 4-12*). Do not stress the antenna cables.

6 Refer to *Figure 4-14* for the correct antenna placement (❶).

To attach the antennas:

a Remove the peel-off covering over the foam tape adhesive.

b Apply the antenna's adhesive pad to the tip of a thin-bladed knife or small flat screwdriver.

c Use the knife or screwdriver to guide the antenna to the correct installation point (refer to *Figure 4-15*). Ensure that the antenna cable is not stressed or kinked.

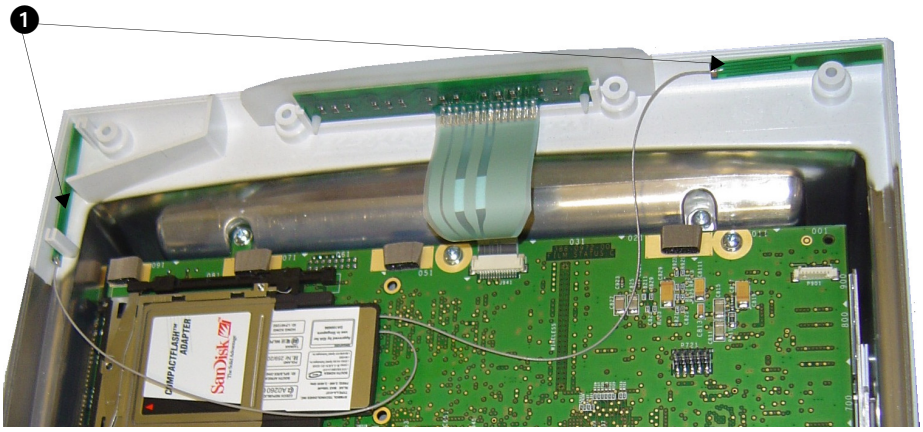


Figure 4-14: Antenna placement

7 Press down firmly, and hold the adhesive pad in place while removing the screwdriver or knife.

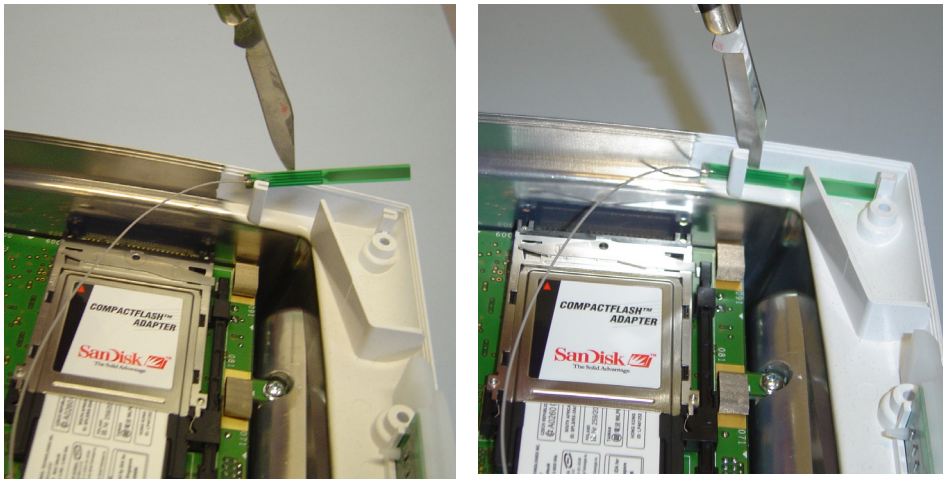


Figure 4-15: Antenna installation, using a knife blade as a guide

Removing the Chassis Assembly

The chassis assembly includes the sheet metal, Interconnect PCBA, and the fan/battery connection assembly.

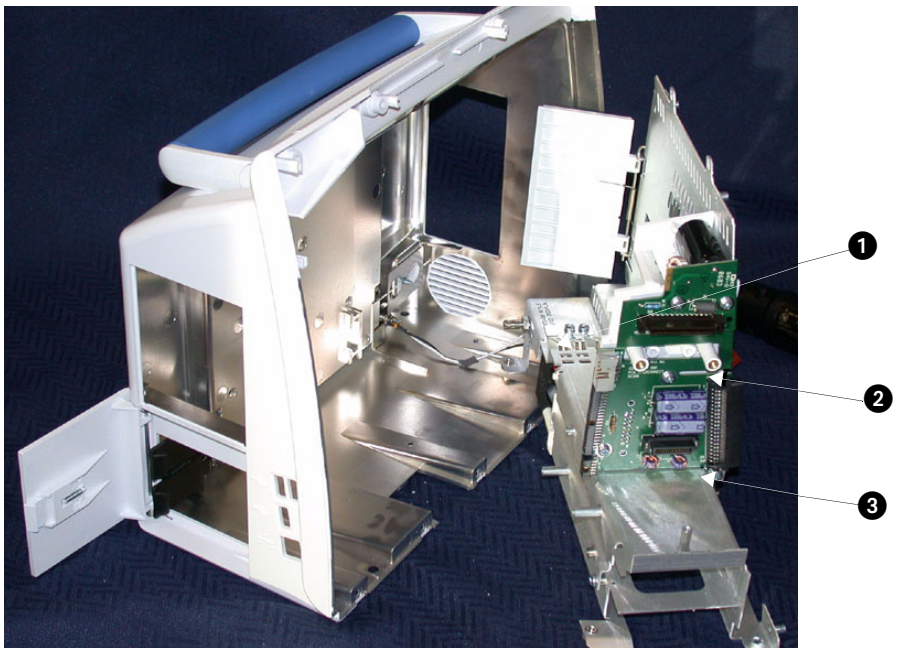


Figure 4-16: Chassis assembly

1. Fan/battery connection assembly
2. Interconnect PCBA
3. Battery enclosure

To remove the chassis assembly:

1. Remove the rear panel, bezel, CPU PCBA, module, and optional recorder and recorder CPU as previously described.
2. Place the monitor face down with the bottom facing you.
3. Remove the screw near the ground terminal area.
4. Remove the two screws with washers from the rear panel.

Note:

These washers must be used when replacing the screws. If they are left out, the screws will penetrate into the battery chassis and interfere with the battery clearance.

5. Remove the three 6/32-inch × 0.375-inch screws from the bottom of the monitor.
6. Turn the assembly over and remove the two top screws to secure the wall of the module compartment to the rear housing.
7. To lift the chassis out of the case, place your left hand through the battery door and your right hand into the module access opening. Work the assembly upward, allowing the top to move ahead of the bottom.
8. The chassis is now ready for further disassembly.

Replacing the Fan/Battery Contact Assembly

1 Remove the chassis assembly from the housing as previously described (refer to *Removing the Chassis Assembly* on page 4-21).

2 Separate the chassis assembly from the module wall assembly by removing the two screws above the battery ejection springs and the two screws near the bottom.

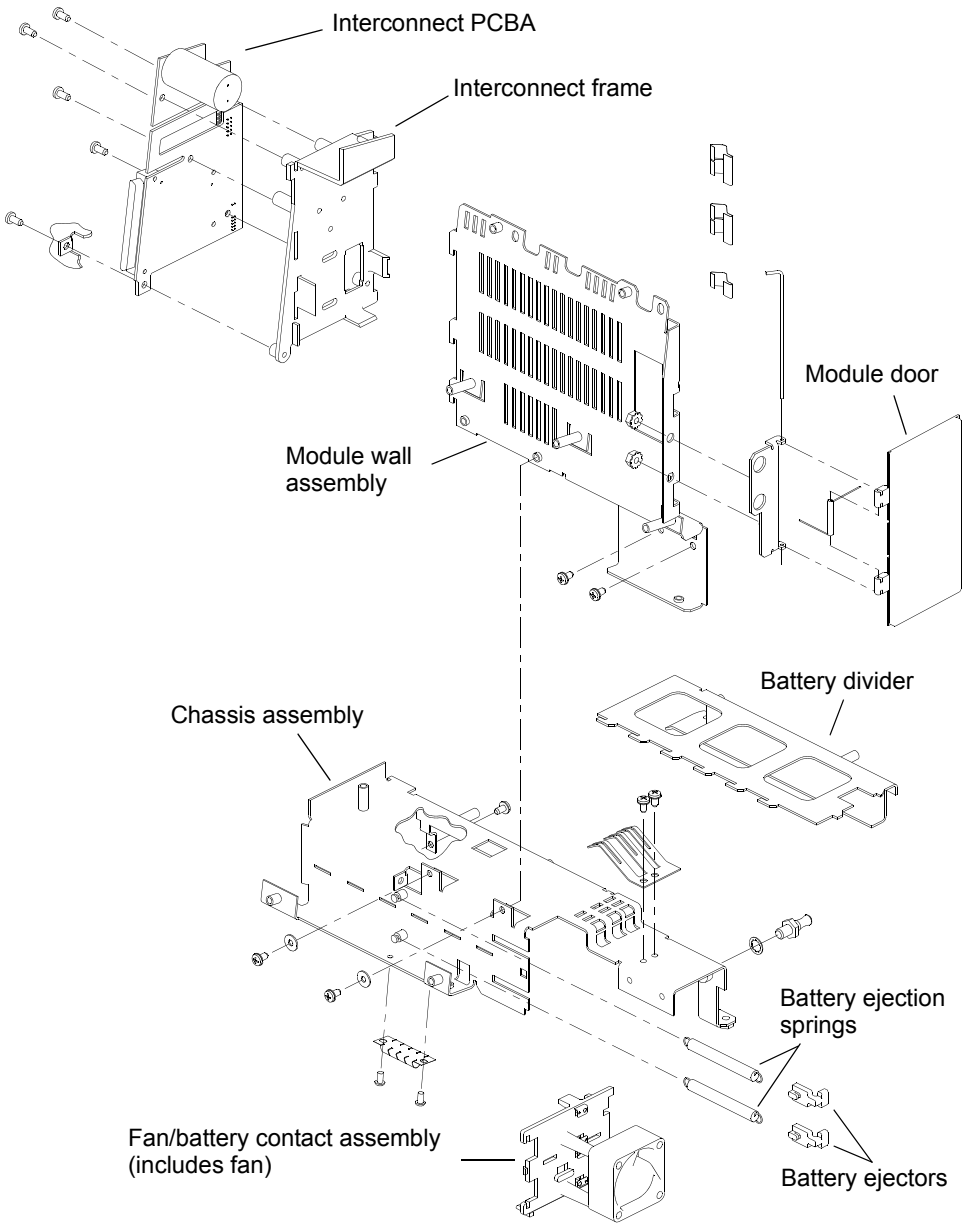


Figure 4-17: Replacing the fan/battery contact assembly and Interconnect PCBA

3 Pry up the center retainer on the battery contact assembly (near the battery ejection springs). This should free the fan/battery contact assembly.

4 Remove the screw between the chassis and the Interconnect PCBA.

Replacing the Interconnect PCBA and Frame

1 Remove the chassis assembly from the housing as previously described.

2 Separate the chassis assembly from the module wall assembly by removing the two screws above the battery ejection springs and the two screws near the bottom.

3 Remove the screw between the chassis and the Interconnect PCBA.

4 Separate the Interconnect PCBA and frame.

5 Reassemble the monitor in reverse order.

Replacing/Aligning the Module Door

1 To remove the door, remove the two nuts fastening the hinge to the wall of the module compartment assembly. This will free the door assembly. When installing a new door, do not tighten the two nuts until the chassis assembly is completely secured to the rear housing.

2 After the chassis and rear housing are mated, position the door and tighten the two nuts.

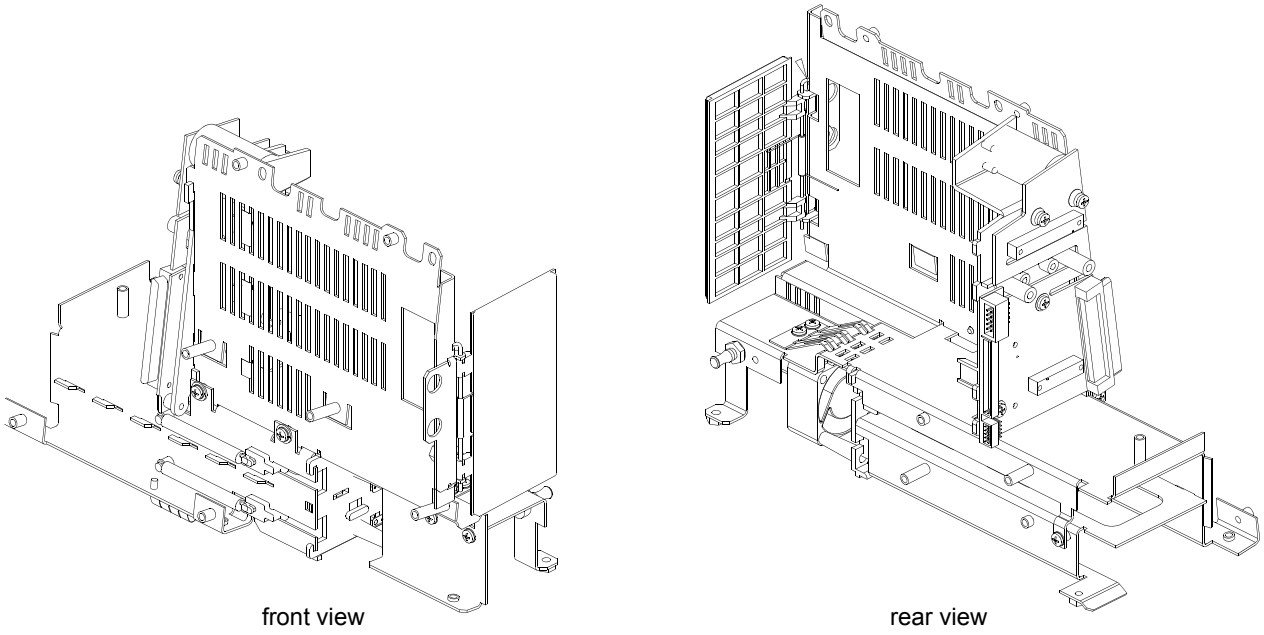


Figure 4-18: Module door

Replacing the Embedded Nurse Alert Assembly

1 Remove the front bezel carefully.

2 Slide out the embedded nurse alert LED assembly.

3 Reverse the procedure to install the replacement.

Cleaning

Clean the case by washing it with mild soap and water or use Plast-N-Glas cleaner. Use TF solvent for cleaning the electronic connectors and contacts as necessary.

Caution:

- **Do not autoclave.**
- **Never use solvents, acetone, abrasive cleaning agents, or abrasive cleaning pads.**
- **Use only approved cleaning agents including 70% alcohol, soap and water, green soap, or 10% bleach solution.**

Note:

Avoid directly spraying liquids into the recorder openings.

Troubleshooting

Contents

Overview

The first several sections describe the available diagnostics features and how to use them. This is followed by a section which lists diagnostics failure messages and the suggested corrective actions. The last section gives specific troubleshooting steps which can be used to isolate failures.

The troubleshooting procedures in this chapter isolate equipment problems to a Field Replaceable Unit (FRU).

The following items are field-replaceable:

- PCBA, Connector
- PCBA, Interconnect
- PCBA, CPU
- All sheet metal and plastic parts
- External DC power supply
- LCD display
- 5-wire resistive touchscreen
- Internal alarm LED assembly
- Power indicator flexboard
- Backlight inverter board

Caution:

Observe precautions for handling electrostatic-sensitive devices!

Note:

- *Never touch electrostatic-sensitive electronic components without following proper anti-static procedures, including the use of an ESD wrist band and mat. An electrostatic discharge from your fingers can permanently damage electronic components and cause latent failures.*
- *All static-sensitive electronic components are packaged in static-shielding bags. Retain the bag should you need to repackage the component for storage or need to return it to Spacelabs for any reason.*

Required Tools and Parts

The following items are necessary for troubleshooting:

- Anti-static mat with wrist strap
- #1 and #2 Phillips-head screwdriver
- 5/16-inch nut driver
- 3/16-inch nut driver
- Multimeter

Problem Solving

Before starting the troubleshooting procedures, first establish that there is a fault by performing the monitor functional tests (refer to *Functional Tests* on page 4-5). Refer to the *Ultraview SL Operations Manual*, P/N 070-1150-xx, for specific information on operation.

System Startup

When the monitor is first powered ON, the **System Startup** window appears.

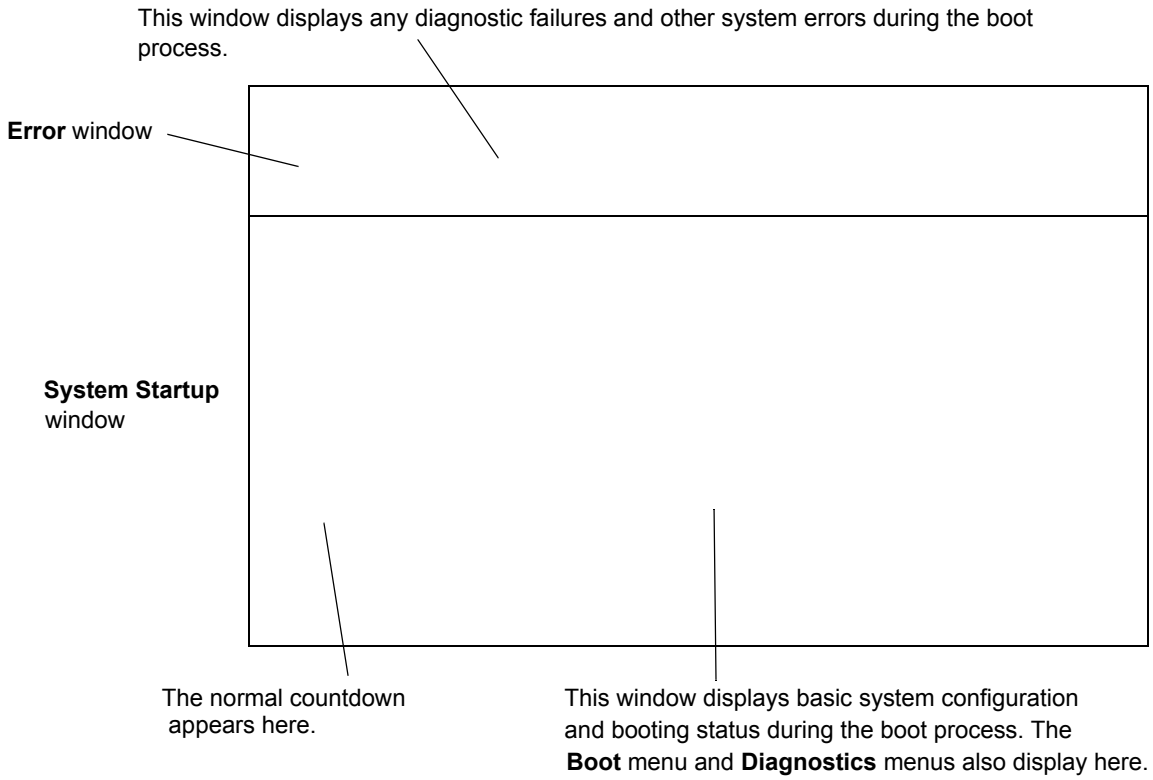


Figure 5-1: System Startup window

When this screen is displayed, the monitor automatically begins power-ON diagnostics. Any diagnostics failures are reported in the upper window. If no serious diagnostics failures are encountered, the monitor continues past this screen and starts normal monitor operation.

During the countdown, the booting operation can be halted and a **Boot** menu of boot options can be displayed.

The **Boot** menu and the power-ON diagnostics are described in the sections that follow.

Boot Menu

The **Boot** menu (*Figure 5-3* on page 5-4) is activated during system startup. It allows access to several basic configuration menus and functions of the monitor, including extended diagnostics. All text displayed on the screen is also output to the serial port.

To activate the Boot menu:

1 Power ON the monitor and wait until it displays the countdown.

2 Before the countdown expires, perform the following step using either the touchscreen, mouse, keyboard, or terminal (or a computer with terminal emulation software) connected to the serial port:

- **Touchscreen** — Touch the bottom left and then the bottom right corner (not simultaneously) of the screen (*Figure 5-2*).
- **Mouse** — Click the left and right mouse buttons simultaneously.
- **Keyboard or terminal** — Press CNTL+D (the terminal's serial port should be set to 9600 baud, no parity, 8 data bits, and one stop bit).

*Figure 5-2: Finger placement to initiate **Boot** menu using the touchscreen during the countdown*

3 The **Boot** menu appears as shown in *Figure 5-3*.

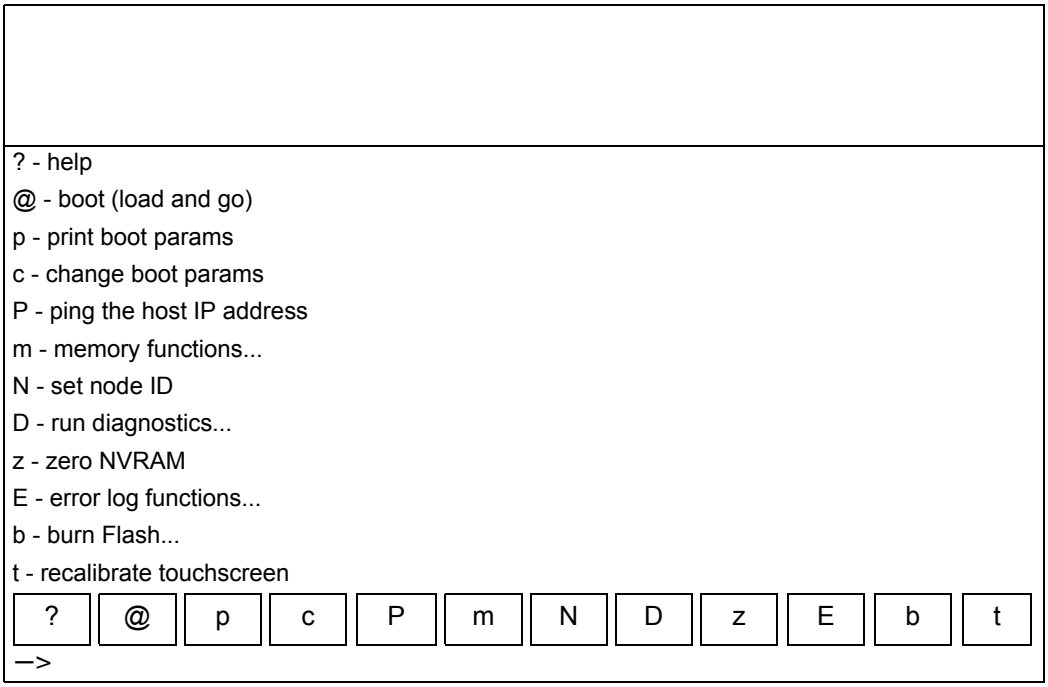


Figure 5-3: Boot menu

Caution:

Use caution when executing functions in this menu. You should only execute Diagnostics (D) or use the Error Log (E). The remaining features should only be accessed by a qualified Spacelabs Medical Field Service Engineer.

Note:

All menu selections are case-sensitive when using a keyboard or terminal.

The following keys are available in the Boot menu:

? — Provides an explanation of this menu.

@ — Starts the monitoring application.

p — Prints the boot parameters (*Figure 5-4* on page 5-5).

c — Allows boot parameters to be changed.

P — Allows this monitor to ping the host IP address [host inet (h)].

m — Requires a data key (Spacelabs field service engineers only). Displays the **Memory** menu (*Figure 5-7* on page 5-9), which allows the display, modification, copying, and filling of any memory or address space accessible to the CPU.

N — Allows the node ID to be changed and sets the monitor ID number in Network Setup.

D — Displays the **Main Diagnostic** menu (*Figure 5-5* on page 5-7).

z — Requires a data key (Spacelabs field service engineers only). Zeros and initializes the NVRAM.

E — Displays the **Error Log Functions** menu, which allows the error log to be cleared or dumped to the screen and serial port.

b — Displays the **Burn Flash** menu, which allows new boot kernel or application software to be loaded over the network and burned into flash memory (Spacelabs field service engineers only).

t — Recalibrates the touchscreen (monitor will reset).

Boot Parameters

Touch the **p** key in the **Boot** menu to display the boot parameters. Touch **Continue** to return to the **Boot** menu.

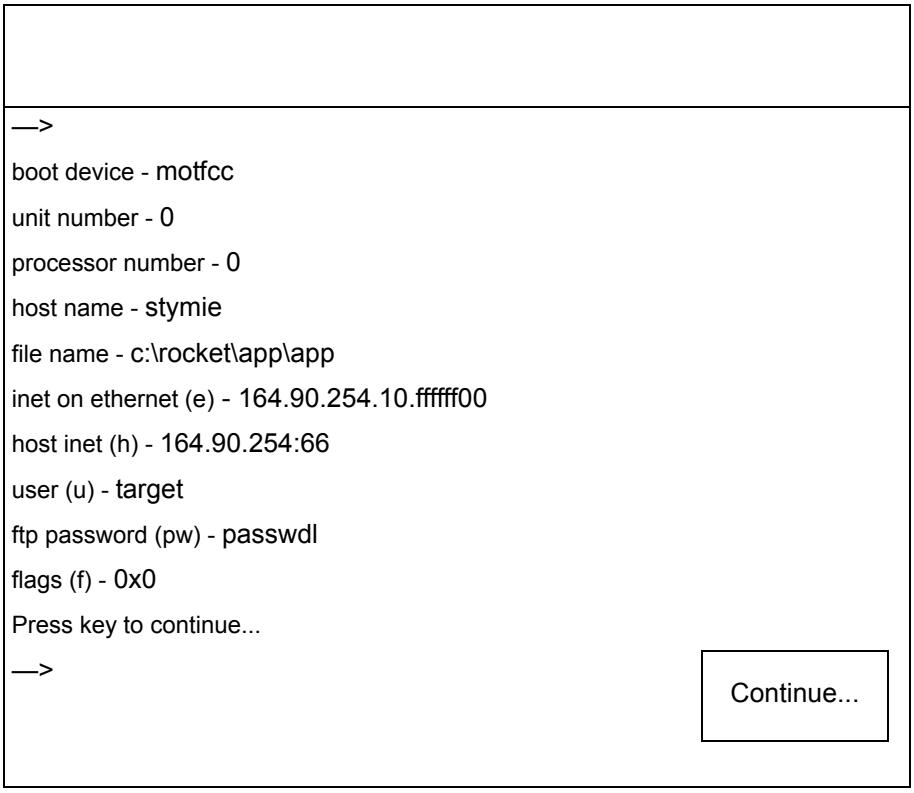


Figure 5-4: Boot Parameters menu with default settings

Power-ON Diagnostics

Power-ON diagnostic tests verify system hardware integrity during power-ON and can often help isolate and troubleshoot a problem. Most of these tests can also be initiated using the Extended Diagnostic Mode.

The diagnostics initiated at power-ON are:

- CPU (reads and writes control registers and does an internal wrap-around of one serial communication controller channel)
- DRAM read/write (reads and writes DRAM above 1 MB)
- Real-time clock (verifies that the clock is running)
- GDS SRAM (reads and writes all of the SRAM, nondestructively)
- PCI bridge (reads and writes control registers)
- ISA bridge (reads and writes control registers)
- Video (tests the video memory, video controller, Hsync, and blue video signals)
- Ethernet (reads and writes control registers)
- Flash checksum (checksums all flash memory)
- Touchscreen (tests the touchscreen controller)
- Audio (reads and writes control registers in the CODEC)

Power-ON diagnostic failures are reported in the upper portion of the **System Startup** screen. Refer to *System Startup* on page 5-2 for additional information

Any error that occurs during one of these tests is logged in the non-volatile configuration memory. Refer to *Error Log* on page 5-10 to retrieve the log

Extended Diagnostics

Extended diagnostic tests, like the power-ON diagnostics, can be used to troubleshoot and isolate many system failures.

The types of tests and features available in the extended diagnostics are:

- Power-ON diagnostics.
- Interactive tests and read/write memory tests that are not appropriate during power-ON diagnostics.
- Touchscreen calibration and data dump utilities.
- System data dump and system reset utilities.

The diagnostic menus allow most of these tests to be run individually or all at once. If Loop mode is activated, a test(s) can be executed in a continuous loop. If Halt On Error mode is activated, the looping stops when a diagnostic failure is detected. To avoid false failures, do not use the touchscreen, mouse, or keyboard while the diagnostic tests are executing.

Extended diagnostics failures are reported in the upper left corner of the **System Startup** screen. Refer to *System Startup* on page 5-2 for more information.

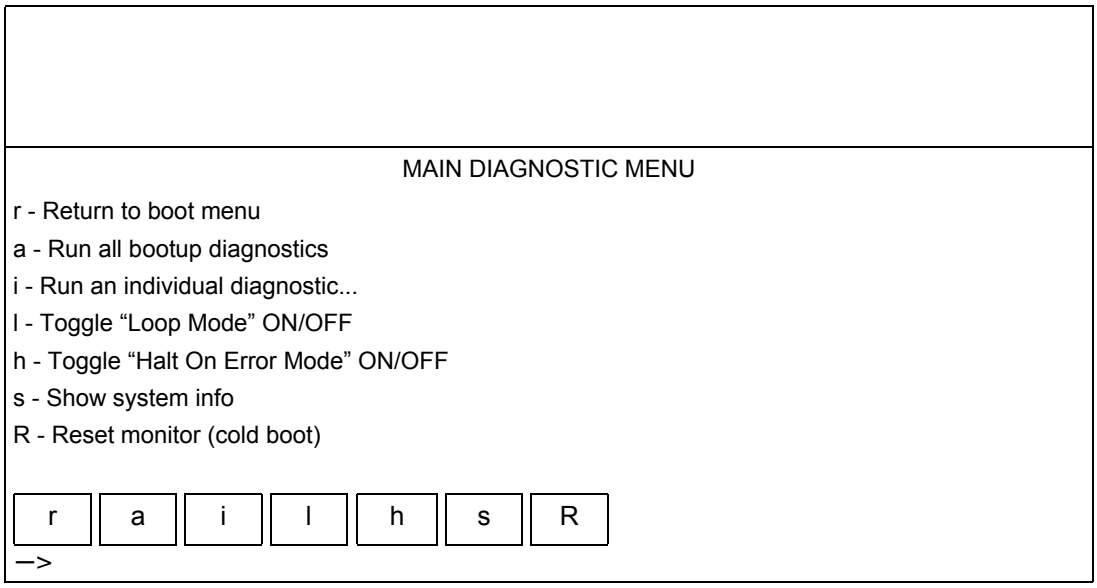
Any error that occurs during one of these tests is logged in the non-volatile memory. Refer to *Error Log* on page 5-10 to retrieve the log.

For detailed information on extended diagnostics and how to run them, refer to *Diagnostic Menus* on page 5-7.

Diagnostic Menus

Main Diagnostic Menu

Touch the **D** key in the **Boot** menu to display the **Main Diagnostic** menu (*Figure 5-5*).



The following functions are available in the **Main Diagnostic** menu:

r — Returns to the **Boot** menu.

a — Runs the same tests that are run during power-ON diagnostics.

i — Displays the **Individual Diagnostic** menu (*Figure 5-6*).

l — Toggles Loop Mode ON or OFF. When Loop Mode is ON, any test or tests that are selected will run in a continuous loop until power is turned OFF.

h — Toggles Halt On Error Mode ON or OFF. When ON, any failure that occurs while tests are running in Loop Mode immediately stops testing.

s — Shows system information, including details of address spaces and variables used in the system.

R — Causes a cold boot reset just like turning the power OFF.

Individual Diagnostic Menu

Touch the **i** key in the **Main Diagnostic** menu to display the **Individual Diagnostic** menu.

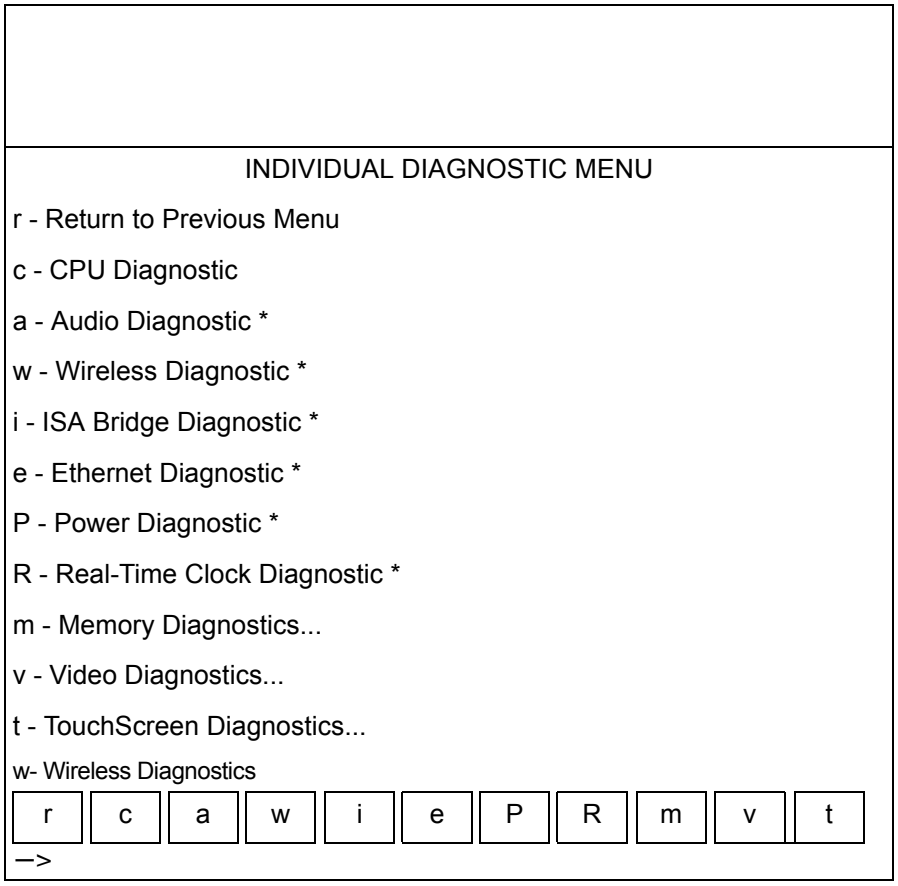


Figure 5-6: Individual Diagnostic menu

The following keys are available in the Individual Diagnostic menu:

r — Returns to the **Main Diagnostic** menu.

c — Tests certain CPU functions, similar, but not identical to, the power-ON CPU test.

a — Runs the power-ON audio diagnostic.

w — Runs the power-ON wireless LAN diagnostic (if installed).

I — Runs the power-ON ISA bridge test.

e — Runs the power-ON Ethernet test.

P — Runs the power-ON diagnostic test.

R — Ensures that the real-time clock is running.

m — Requires a data key (Spacelabs field service engineers only) for some functions. Displays the **Memory** menu (*Figure 5-7*).

v — Displays the **Video** menu.

t — Displays the **Touchscreen** menu.

t — Runs the wireless diagnostic.

Memory Menu

Touch the **m** key in the **Individual Diagnostic** menu to display the **Memory** menu.

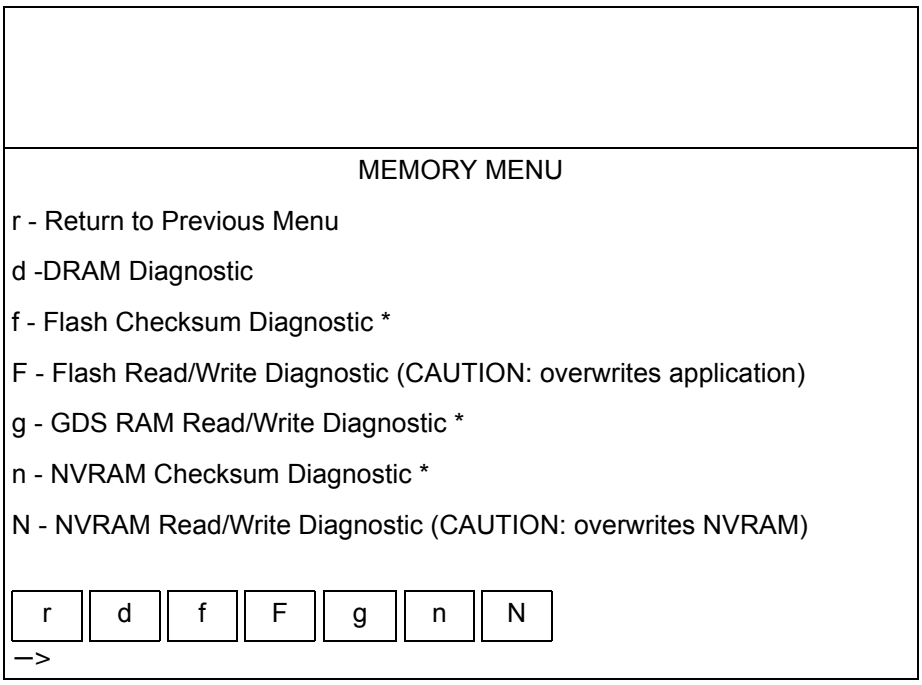


Figure 5-7: Memory Menu

The following keys are available in the Memory menu:

r — Returns to the **Individual Diagnostics** menu.

d — Runs a DRAM test, similar to the power-ON DRAM test, but tests only the memory not in use by the boot kernel.

f — Performs the power-ON flash checksum.

F — Performs a read/write test on the application area of flash memory, which overwrites the application software. Reload the software after the test. Requires a data key (Spacelabs Medical Field Service Engineers only).

g — Runs the power-ON GDS SRAM test.

n — Performs a checksum on NVRAM.

N — Performs a read/write test of NVRAM, which overwrites configuration parameters in NVRAM. After completing the NVRAM test, NVRAM should be zeroed and the boot parameters and sysgen values should be re-entered. Requires a data key (Spacelabs Medical Field Service Engineers only).

Video Menu

Touch the **v** key in the **Individual Diagnostic** menu to display the **Video** menu.

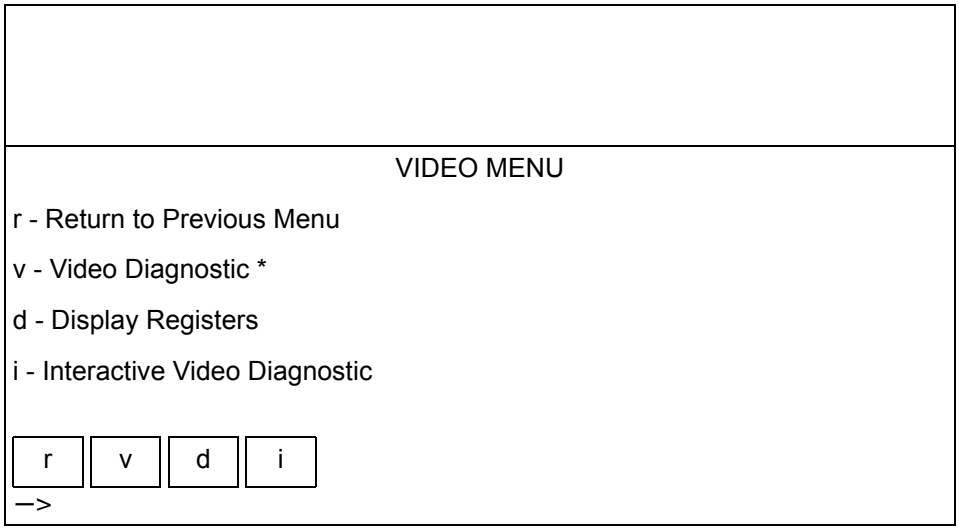


Figure 5-8: Video Menu

The following keys are available in the Video menu:

r — Returns to the **Individual Diagnostics** menu.

v — Runs the power-ON video diagnostic.

d — Displays the registers.

i — Runs an interactive video diagnostic, which displays red, green, blue, white, and black screens, for five seconds each. Inspect the screen for faulty pixels.

Error Log

For troubleshooting intermittent problems, the monitor maintains an error log for both recoverable and non-recoverable errors in its battery-backed, non-volatile memory. All diagnostics failures are logged in the error log.

Most errors relate to the CPU PCBA, but some errors may be caused by the parameter module or software errors. For example, a particular sequence of key strokes that always produces the same error code could be a software problem.

Displaying the Error Log

Before using the Error Log, ensure that all other procedures have been followed, including elimination of operator errors, testing of voltages, correction of display faults, diagnostic testing, cabling/connector repairs, software compatibility, etc.

From the **Boot** menu (refer to *Boot Menu* on page 5-3), touch **E** to access the **Error Log Functions** menu, then **d** to view the Error Log.

Clearing the Error Log

Press **E**, then press **c** to clear the error codes automatically the next time the monitor application executes.

Diagnostics Failure Messages and Error Codes

If the monitor fails power-ON diagnostics or extended diagnostics, do the following:

1 Verify the failure by powering the monitor OFF and ON again or by running the extended diagnostics as described in *Extended Diagnostics* on page 5-6 and *Diagnostic Menus* on page 5-7.

2 Take troubleshooting action or replace the field-replaceable units (FRU) based on the following diagnostics failure messages once the failure has been verified.

Table 1: Diagnostic Failure Messages

Error Code	Diagnostics Failure Message	Suggested Action
01030000	*Diagnostics passed*	No action required.
01030001	*Diagnostic(s) failed; degraded performance*	Replace CPU PCBA.
01030002	*Critical failure*	Replace CPU PCBA.
01030003	*Cannot diagnose at this boot stage*	No information available.
01030100	*Diagnostics Port test failed*	Replace CPU PCBA.
01030200	*8260 test failed*	Replace CPU PCBA.
01030201	*8260 SCC transmit failed*	Replace CPU PCBA.
01030202	*8260 SCC configuration not recognized*	Replace CPU PCBA.
01030300	*DRAM test failed*	Replace CPU PCBA.
01030301	*DRAM test cannot allocate memory*	Reboot and retest. If problem persists, replace CPU PCBA.
01030400	*GDS RAM test failed*	Replace CPU PCBA.
01030500	*FLASH ROM test failed*	Replace CPU PCBA.
01030501	*FLASH ROM boot larger than Flash*	Reburn boot kernel software into flash memory and retest. If failure persists, replace CPU PCBA.
01030502	*FLASH ROM app larger than Flash*	Reburn application software into flash memory and retest. If failure persists, replace CPU PCBA.

Table 1: Diagnostic Failure Messages (continued)

Error Code	Diagnostics Failure Message	Suggested Action
01030503	*FLASH ROM boot checksum error*	Reburn boot kernel software into flash memory and retest. If failure persists, replace CPU PCBA.
01030504	*FLASH ROM app checksum error*	Reburn application software into flash memory and retest. If failure persists, replace CPU PCBA.
01030505	*FLASH ROM read/write memory test error*	Replace CPU PCBA.
01030600	*Power Subsystem test failed*	Replace CPU PCBA.
01030601	*A2D Converter failed to convert*	Replace CPU PCBA.
01030602	*Invalid power request*	Replace CPU PCBA.
01030603	*Temperature out of spec*	Replace CPU PCBA.
01030700	*PCI Bridge test failed*	Replace CPU PCBA.
01030701	*PCI Bridge configuration not recognized*	Replace CPU PCBA.
01030702	*PCI Bridge registers are not writable*	Replace CPU PCBA.
01030703	*PCI Bridge revision not valid for clinical use*	Replace CPU PCBA.
01030800	*Ethernet test failed*	Replace CPU PCBA.
01030801	*Ethernet setup failed*	Replace CPU PCBA.
01030802	*Ethernet transmit failed*	Replace CPU PCBA.
01030900	*ISA Bridge test failed*	Replace CPU PCBA.
01030A00	*Video test failed*	Replace CPU PCBA.
01030A01	*Invalid display type*	Replace CPU PCBA.
01030A02	*Invalid display size*	Replace CPU PCBA.
01030A03	*Video configuration not recognized*	Replace CPU PCBA.
01030A04	*Video DRAM failure*	Replace CPU PCBA.
01030A05	*Video could not detect hsync signal*	Replace CPU PCBA.
01030A06	*Video could not detect blue video signal*	Replace CPU PCBA.
01030C00	*OS error while diagnosing KBD*	Reboot and retest. If problem persists, replace CPU PCBA.
01030C01	*Cannot access KBD device registers*	Replace CPU PCBA.

Table 1: Diagnostic Failure Messages (continued)

Error Code	Diagnostics Failure Message	Suggested Action
01030C02	*KBD did not respond to command*	Replace CPU PCBA.
01030C03	*KBD failed selftest*	Replace CPU PCBA.
01030C04	*KBD failed interface test*	Replace CPU PCBA.
01030D00	*Cannot access AUDIO device registers*	Replace CPU PCBA.
01030D01	*Could not open audio device*	Reboot and retest. If problem persists, replace CPU PCBA.
01030D02	*Audio device did not respond correctly*	Replace CPU PCBA.
01030D03	*Audio Loopback test failed*	Replace CPU PCBA.
01030E00	*NVRAM test failed*	Replace CPU PCBA.
01030E01	*NVRAM clock not running*	Replace CPU PCBA.
01030E02	*NVRAM checksum error*	Zero the NVRAM and reboot. Re-program all items in the **Biomed**, **CSR**, and **Clinical** menus (Spacelabs field service engineers only). If problem persists, replace CPU PCBA.
01030E03	*NVRAM read/write memory test failed*	Replace CPU PCBA.

System Troubleshooting

This section describes troubleshooting procedures which can be used in conjunction with, or separately from, the diagnostics to isolate a failure.

Required Tools/Test Equipment

#1 Phillips screwdriver

Display

Garbled Display, No Display, or Touchscreen Response

1 Ensure that the external DC power supply is properly connected (power LED to the right of the power ON/OFF switch is illuminated). If the light is OFF, troubleshoot the external power supply.

2 Cycle the power ON/OFF switch several times and verify that the graphic on the power switch illuminates. If no light is evident, the +5 V power supply on the CPU is not present and will require troubleshooting.

3 Remove the plug-in patient parameter module. Cycle the power ON/OFF switch to verify that the graphic on the power switch illuminates. If it does not illuminate, sequentially remove each of the following assemblies, cycle the power, and check for a tone before removing the next assembly.

- Optional recorder assembly and its CPU PCBA.
- The I/O PCBA.

If the power switch illuminates after removing one of these assemblies, repair or replace that assembly. If the power switch still does not illuminate, go to step 4.

Caution:

- **Partial disassembly may be required for troubleshooting. Ensure that the external power supply and rechargeable battery(ies) are disconnected. When disassembling the monitor, use a nonconductive, anti-static material to insulate the CPU PCBA from the front bezel assembly (a piece of cardboard will suffice).**
- **The ends of the cables that connect the front bezel of the CPU PCBA to the display must be handled with care. When disconnecting this cable, the latch should be gently lifted using finger pressure. A broken latch may still lock the cable into the connector, but it will not provide guidance for centering the cable into the connector.**

4 Remove the front bezel assembly. Once the CPU PCBA is accessible, check the cable connections between it and the display and verify that the backlight is visible.

5 If problem persists, replace CPU PCBA.

If the entire display is garbled or distorted:

- Check the cables and connectors interfacing the display to the CPU PCBA. A patient parameter module may need to be installed to view the top half of the display. If the connections are okay, replace first the CPU PCBA, then the display screen.

Caution:

Do not attempt to troubleshoot the display backlight electronics. There are very HIGH AC voltages in this area. Only qualified Spacelabs Medical field service engineers should attempt to troubleshoot this section.

Monitor Fails Power-ON Diagnostics

Troubleshooting Method 1: Using the Touchscreen or Mouse

1 Display the **Main Diagnostic** menu.

This menu is activated using the touchscreen or mouse. Press the left and right mouse buttons simultaneously, or touch the lower left and then the lower right corners, one at a time, during the “4, 3, 2, 1” countdown.

2 Click (or touch) the Test Parameter key that retests the previously indicated failure.

Upon verification of the failure, a message provided by the monitor directs you to the field-replaceable unit that failed.

Troubleshooting Method 2: Using the Remote Terminal

1 Attach a remote terminal (9600 baud, no parity, 8 bits, 1 stop bit) to the serial connector.

2 Power ON the monitor.

3 Activate the **Serial Diagnostic** menu by pressing CTRL D during the “4, 3, 2, 1” countdown at system startup.

4 All power-ON tests can be performed to isolate the problem to a PCBA. The monitor will guide you to the appropriate field replaceable unit.

Touchscreen

If the display is present but the touchscreen is unresponsive:

1 Calibrate the touchscreen (refer to *Diagnostic Menus* on page 5-7) using the mouse. Check the operation again.

2 Run the Interactive Touchscreen test (refer to *Diagnostic Menus* on page 5-7).

3 Remove the external power supply and battery(ies) and check the connections interfacing the touchscreen to the CPU PCBA. If the connections are okay, replace the CPU PCBA.

Module Slot

1 Verify the module’s operation on another monitor (if available).

2 Check the software versions of all installed modules, Flexport interfaces, and other SDLC equipment attached, verifying with Spacelabs Medical that there are no incompatibilities.

3 Inspect the Interconnect PCBA. If any connectors or parts appear damaged, replace the damaged assembly.

4 If the problem persists, replace the CPU PCBA and the Interconnect PCBA, in that order.

SDLC Output

1 If a module housing is present, verify that the proper SDLC terminations are set and that the proper cables are being used (refer to *Setup* on page 2-1 for more information).

2 Check the software versions of all installed modules, Flexport interfaces, and other SDLC equipment attached, verifying with Spacelabs Medical that there are no incompatibilities.

3 Inspect the I/O (Connector) PCBA and the Interconnect PCBA. If any connectors or parts on either of these assemblies appear damaged, replace the damaged assembly.

4 If the problem persists, replace the CPU PCBA.

Ethernet

1 Check the network setup and verify that the correct monitor ID, monitor name, and subnet were entered.

2 If any changes are made in step 1, power OFF, then power ON for the changes to take effect.

3 Check for the green LED on the network connector showing a “LINK.” Verify that the green LED is flashing about once every five seconds or faster, indicating network activity. The yellow LED will be ON when connected to a 100BaseT network and OFF when connected to a 10BaseT network.

4 Check the Ethernet cable for correct termination, and ensure that it is attached to a hub that is ON and functional. Use another Ethernet cable and test with a different monitor to verify the hub port is functional.

5 Replace the switch or hub.

6 If the problem persists, replace the CPU PCBA.

For a list of network configuration messages and their causes, refer to *Network Configuration Messages* on page 2-27.

Wireless Option

To run wireless diagnostics:

1 Restart the monitor with the network cable detached. Wait until the monitor displays the countdown.

2 Start boot diagnostics during the power ON sequence:

a Touch the lower left corner of the touchscreen.

b Touch the lower right corner of the touchscreen. Refer to *Boot Menu* on page 5-3 for additional information.

c Select **D - run diagnostics**.

The **Main Diagnostics** menu displays.

d Touch **i - Run an individual diagnostic**.

e Touch **w - Wireless diagnostic**.

The monitor enters the wireless diagnostic. Do NOT interact with the monitor, touchscreen, keyboard, or mouse while the diagnostic is running. When the diagnostic completes, the monitor will display one of the following messages:

Complete. No errors detected. Exit the diagnostic and restart the monitor to continue.

-OR-

Wireless card not present. Check that the radio card and the PCMCIA card adapter are properly seated and that there is no connector damage. If the radio card connection appears to be good, the radio card, the PCMCIA card adapter, or CPU PCBA may need to be replaced.

-OR-

Error detected! Check that the radio card and the PCMCIA card adapter are properly seated and that there is no connector damage. If the radio card connection appears to be good, the radio card, the PCMCIA card adapter, or CPU PCBA may need to be replaced.

Note:

Verify that the monitor’s on-screen display options includes the letter z; if the monitor does not, contact you Spacelabs Medical Field Service Representative.

Checking the Wireless Configuration

1 Verify that the wireless network is properly configured through the **BIOMED LEVEL** menu. Select **NETWORK SETUP**. The configuration parameters for the wireless card are located under the **WLAN**, **Security**, and **Advanced** tabs. Refer to *Network Setup* on page 2-13 for instructions on configuring these tabs.

The critical information on these tabs are:

- the radio is enabled (if not, check all other WLAN settings before enabling the radio);
- the WLAN IP address and subnet (refer to *WLAN Tab* on page 2-19);
- the **SSID** setting (refer to *WLAN Tab* on page 2-19);
- whether security is enabled (refer to *Security Tab* on page 2-24);
- the WEP key is "enabled" (*Security Tab* on page 2-24);
- and whether **Region** is set to for the appropriate region code (refer to *Region Codes* on page 2-22).

2 Power ON the monitor with the network cable detached, and then verify that the wireless signal strength indicator displays in the bottom right corner of the screen. If the wireless signal strength indicator is not present, the monitor does not find a wireless card. If the wireless signal strength indicator is yellow, it indicates that the radio is not associated with an access point, that the WEP setting is incorrect, or that the IP configuration must be reviewed.

On the **Biomed Level** menu, select MORE, then select SYSTEM INFO. Select the WLAN key. If the screen indicates ASSOCIATED and has an access point (AP) listed with an asterisk (*) to the left of the AP address, the monitor is using that AP to access the network. (Refer to *Figure 2-24* on page 2-38).

It is possible for the monitor to indicate acceptable radio signal strength while there is still no network communication. This may be due to a security setting or a TCP/IP configuration problem.

3 Verify that both antennas are plugged into the wireless card. Verify that the PCMCIA adapter is plugged firmly into the PC Card/PCMCIA socket on the CPU board and that the radio card is properly seated into the adapter.

4 Verify that CPU board part number 670-1275-03 or later is installed. On the **Biomed Level** menu, select MORE, then select SYSTEM INFO. The CPU board part number displays at the top of the screen (refer to *Figure 2-21* on page 2-36).

5 If the above does not solve the problem, replace the CPU PCBA.

Alarm Relay

1 Verify the operation of the external alarm device. Replace if it does not work correctly.

2 Verify that the alarm cable is installed correctly and that pin 9 on the connector has +12 V.

3 Inspect the I/O PCBA and the Interconnect PCBA if the problem persists. If any connectors or parts on either of these assemblies appear damaged, replace the damaged assembly.

4 If the problem persists, replace the CPU PCBA.

External Display

1 Check the external display's power and video cables for proper connections. Verify that the display assembly is set in the correct operating mode.

2 Verify that the external display's brightness, vertical, and horizontal sync are set correctly.

3 Verify that the external display's terminations are set for 75 ohms, if settable.

4 Run the Video Diagnostic (refer to *Individual Diagnostic Menu* on page 5-8). If it fails, replace the CPU PCBA.

5 Inspect the Interconnect PCBA and I/O PCBA. If any connectors or parts on either of these assemblies appear damaged, replace the damaged assembly.

Keyboard, Mouse, or Barcode Scanner

1 Try a known good USB mouse or keyboard (there is no setup for the mouse or keyboard, either externally or internally). Cycle the power OFF and ON after changing the keyboard or mouse to guarantee that they are seen by the monitor.

2 Check the USB connector for damage, and replace the damaged assembly if necessary.

3 Try a known good USB mouse in all the USB ports. If none work, replace the CPU PCBA.

Barcode Scanner

Ensure the barcode scanner is set for keyboard entry mode.

Battery

The monitor can assist in troubleshooting failed batteries in several ways. It can detect gross failures such as shorted and weak batteries and batteries that cannot hold a charge. It cannot detect all battery failure modes. To debug a problem battery, run the following tests.

Battery Charging Test

1 Install one or two suspect batteries.

2 Power the monitor from the AC power supply and switch the monitor OFF. The front panel battery LED(s) will be ON or blinking.

3 Let the batteries cycle through a complete charge. For batteries that are initially charged, wait at least one hour and 40 minutes. For batteries that are initially uncharged, wait at least three hours.

4 Check the front panel battery LED(s). If a faulty battery is detected, the front panel LED(s) blinks ON and OFF at a rate of 500 ms.

5 Replace the bad battery or batteries.

Battery Fuel Gauge

When the monitor is powered by batteries only, with one or two batteries installed, a battery fuel gauge is displayed in the lower right corner of the screen. This gauge is useful in detecting bad batteries or other voltage problems in the system. After five minutes of operation on only one fully charged battery, if the battery fuel gauge reads 3/4 full or less, the battery may be faulty.

Battery Charger

To verify that a faulty charger exists on the CPU PCBA, do the following:

1 Install a known good, fully discharged battery.

2 Power the monitor from the AC power supply and switch the monitor OFF. If the front panel battery LED does not blink, replace the CPU PCBA.

3 Let the battery cycle through a complete charge (90-120 minutes with monitor OFF).

Note:

The indicated time is for NiMH batteries only.

4 Check the front panel battery LED. It should be ON and not blinking. If not, replace the CPU PCBA. (Also, if the LED blinks for more than an hour, the charger is likely faulty).

Recorder

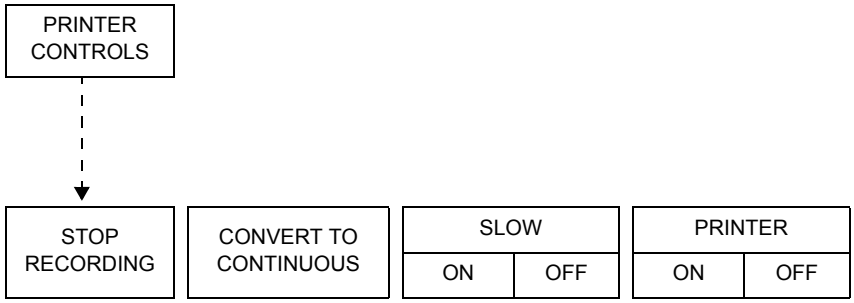


Figure 5-9: Printer Controls menu

The optional recorder downloads the printer control keys after it signs onto the SDLC bus. All of the printer control keys are initially inactive. The PRINTER ON/OFF key becomes active only if the recorder signs onto the SDLC bus with both an alive packet and on-line packet. If there is some failure in this process, the PRINTER ON/OFF key remains inactive. If this key is active and later becomes inactive, then a failure has deleted the recorder module from the SDLC bus.

At power-ON, LED D2 on the recorder CPU PCBA (located under the recorder assembly) will be ON. As the recorder executes its diagnostics, the LED will light ON and OFF with successive tests. If all diagnostics pass, the recorder will sign on to the SDLC link with the LED OFF. If a diagnostic error occurs, the LED is left ON or flashing.

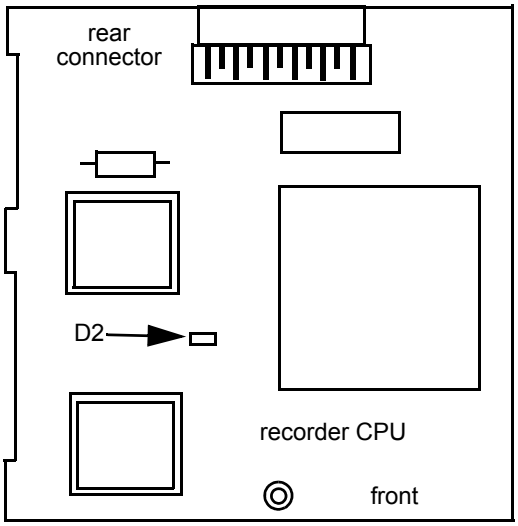


Figure 5-10: Location of D2 on recorder CPU

If a diagnostic error occurs, the recorder will attempt to print a diagnostic line instead of its usual sign-on message. This line is a series of hex numbers. Non-zero numbers represent error codes.

If the recorder is recognized by the monitor at power ON, a PRINTER CONTROLS key is present.

Recorder Tips

If the PRINTER CONTROLS key is not displayed on the monitor:

1. Unplug the external power supply and remove any batteries.
2. Remove the recorder assembly by opening the paper door and loosening the two captive screws.
3. Remove the recorder CPU by loosening the thumb screw that fastens it to the chassis, pulling it outward, and lifting it out.
4. Re-install the recorder CPU by firmly inserting it into the connector. Occasionally when installing a recorder CPU, a second effort proves that the connection was not fully seated. Tighten the thumb screw.
5. Re-install the recorder assembly. Reinstall the batteries, connect the external power supply and power the monitor ON. If the recorder door is closed and paper is properly loaded, the recorder CPU initiates a self-test. If the test is successful, a line of 1/4-inch bars will print on the paper followed by the recorder's model number, software version, and software date.
6. If the self-test fails, open the recorder door and remove the paper.
   - If the diagnostics detected a software failure on the recorder CPU, LED D2 will be steadily ON.
   - If the diagnostics detected a hardware failure in the recorder assembly, LED D2 will be continuously flashing ON and OFF.
   - If no failures were detected, LED D2 will be OFF.
   - During normal operation, D2 will be dimly lit (it is actually flashing very rapidly).

7 If the recorder and the associated interface circuitry is good, an error report line is printed upon detection of an error. LED Error Codes are shown in *Table 2*. The error codes may be helpful for determining whether the error originates from the interconnect board, the recorder CPU, or the OEM recorder module. Refer to LED D6 in step 6 first; use the printed error code (if available) for possible additional information.

Table 2: Recorder Error Codes

Error Code (hex)	Failed Assembly or Likely Cause
80	*EPROM checksum bad*
8F	*Stack pointer bad*
81	*Internal RAM will not write all zeroes*
82	*Internal RAM will not write all ones*
83	*Timer 0 - No overflow*
84	*Timer 0 - High byte bad*
85	*Timer 0 - Low byte bad*
86	*Timer 1 - No overflow*
87	*Timer 1 - High byte bad*
88	*Timer 1 - Low byte bad*
30	*SDLC Errors - Bad Xmit status*
31	*SDLC Errors - No SI*
32	*SDLC Errors - No start flag*
33	*SDLC Errors - Bad address*
34	*SDLC Errors - Bad frame type*
35	*SDLC Errors - No end flag*
10	*Stuck I/O bus bit 0 low*
11	*Stuck I/O bus bit 1 low*
12	*Stuck I/O bus bit 2 low*
13	*Stuck I/O bus bit 3 low*
14	*Stuck I/O bus bit 4 low*
15	*Stuck I/O bus bit 5 low*
16	*Stuck I/O bus bit 6 low*

Table 2: Recorder Error Codes (continued)

Error Code (hex)	Failed Assembly or Likely Cause
17	*Stuck I/O bus bit 7 low*
18	*Stuck I/O bus bit 0 high*
19	*Stuck I/O bus bit 1 high*
1A	*Stuck I/O bus bit 2 high*
1B	*Stuck I/O bus bit 3 high*
1C	*Stuck I/O bus bit 4 high*
1D	*Stuck I/O bus bit 5 high*
1E	*Stuck I/O bus bit 6 high*
1F	*Stuck I/O bus bit 7 high*
50	*External RAM - Stuck bit - Bank 0*
51	*External RAM - Stuck bit - Bank 1*
52	*External RAM - Stuck bit - Bank 2*
53	*External RAM - Stuck bit - Bank 3*
58	*3-Par RAM test error - Bank 0*
59	*3-Par RAM test error - Bank 1*
5A	*3-Par RAM test error - Bank 2*
5B	*3-Par RAM test error - Bank 3*
22	*Front Panel key input error*
23	*EEPROM Tests - Checksum bad - No diagnostic jumper*
25	*EEPROM Tests - Error during checksum write*
26	*EEPROM Tests - New checksum no good*
38	*Printer Tests - WRRDY inactive or -SYNC active after reset*
39	*Printer Tests - Readback system wrong state after reset*
3A	*Printer Tests - Error active after reset*
3B	*Printer Tests - +BUSY not active after idle CMD*
3C	*Printer Tests - +BUSY not inactive after idle CMD*

Table 2: Recorder Error Codes (continued)

Error Code (hex)	Failed Assembly or Likely Cause
3D	*Printer Tests - Error not active after illegal CMD*
3E	*Printer Tests - Error not inactive after idle CMD*
3F	*Printer Tests - +BUSY not inactive after idle CMD*
40	*Printer Tests - Incorrect feedback after illegal CMD*
41	*Thermal array over-temperature*
42	*Low 12 V supply to AR42 recorder*
43	*High 12 V supply*
44	*Other AR42 error*
27	*Error detected during print test*
2A	*SDLC cable not present*
2B	*SDLC clock frequency too high*
2C	*SDLC clock frequency too slow*
2E	*Watchdog timeout too short*
2F	*Watchdog timeout too long*
D1	*Stack error*
67	*Printer error code - Printer did not like command sent*
60	*Manual re-init seen*
69	*Printer error during initialization*
C0	*Unload state error - Invalid state*
A1	*Already printing when another print command received*

Parts

Contents

Overview

This chapter presents exploded views of monitor assembly and PCBA schematics for the monitor.

Caution:

Observe precautions for handling electrostatic-sensitive devices!

Note:

- *Never touch electrostatic-sensitive electronic components without following proper anti-static procedures, including the use of an ESD wrist band and mat. An electrostatic discharge from your fingers can permanently damage electronic components and cause latent failures.*
- *All static-sensitive electronic components are packaged in static-shielding bags. Retain the bag for repackaging the component should you need to store it or return it to Spacelabs Medical for any reason.*

Parts List

Field-Replaceable Parts

Table 1: Field Replaceable Parts

Description	Part Number
PCBA, CPU, 91369	670-1275-05
PCBA, Interconnect, 91369	670-0849-xx
Assembly, I/O Bay, SDLC, Alm, Eth, Com, 91369	670-1302-xx
Assembly, Nurse Alert	650-1425-xx
Assembly, 91369, Power Monitor Switch	650-1429-xx
Touchscreen, 5-Wire Resistive, 10.4 inch	010-1445-00
Display, LCD, Color, TFT, 640 × 480, NEC	150-0340-00

Table 1: Field Replaceable Parts (continued)

Description	Part Number
Inverter, Backlight, CCFL, Dual Tube App.	010-1603-00
Backlight, NEC, Replacement Kit	050-0353-00
Power Supply	119-0479-00
Battery, NiMH, 12 V, 2.45 AH	146-0055-00
PCBA, Recorder CPU, 91369	670-0624-05
Service Kit, Recorder, option U	119-0191-03
Fan Assembly, 40 mm, 12 V	119-0186-01
Plug, Recorder	134-0032-02
Internal, Chassis, 91369	441-0073-01
Frame, Contact Assembly with Fan	650-0279-01
Bezel, Front	203-0231-00
Panel, Rear, 91369	333-0887-00
Retainer, Handle, 91369	343-0372-00
Handle, Enclosure, 91369	367-0833-00
Frame, Interconnect	426-0039-04
Frame, Contact, 91369	426-0041-01
Enclosure, Rear, 91369	437-5045-00
Plug, Hole, SDLC Port, 91369	134-0044-01
Latch, Battery	105-0038-01
Door, Battery	202-0228-00
Spring, Battery Door	214-0328-00
Pin, Hinge, Battery Door	214-0318-00
Ejector, Battery	214-0317-01

Table 1: Field Replaceable Parts (continued)

Description	Part Number
Spring, Extension	214-0333-01
Adapter, Compact Flash to PC Card	103-0210-00
Compact Flash Radio Card (Symbol LA4137-1002-WW)	010-1644-00
Antenna, Nearson AA02-01385	117-0165-00
Recorder, option J	119-0497-00

Cables and Adapters

Table 2: Cables and Adapters

Description	Part Number
Cable, Serial I/O (RS-232)	012-0182-02
Cable, Video, Male DB15HD to Male DB15HD	012-0593-00
Cable, Monitor to Module Housing, 2 feet (0.61 m)	012-0532-02
Cable, Monitor to Module Housing, 4 feet (1.22 m)	012-0532-04
Cable, Monitor to Module Housing, 8 feet (2.44 m)	012-0532-08
Cable, Monitor to Module Housing, 10 feet (3.05 m)	012-0532-10
Cable, Assembly, Ethernet, 10/100BaseT, 3 feet (0.94 m), PVC	175-0951-00
Cable, Assembly, Ethernet, 10/100BaseT, 6 feet (1.8 m), PVC	175-0951-01
Cable, Assembly, Ethernet, 10/100BaseT, 12 feet (3.7 m), PVC	175-0951-02
Cable, Assembly, Ethernet, 10/100BaseT, 20 feet (6.1 m), PVC	175-0951-03

Field-Replaceable Mounting Hardware Parts

Table 3: Mounting Hardware Replaceable Parts

Description	Part Number
Bed Rail Mount, 91369	016-0369-00
Power Supply Mount, Universal	016-0732-00

Miscellaneous Parts

Table 4: Miscellaneous Parts

Assembly	Description	Part Number
Keyboard/Mouse Combo	USB, U.S., Wireless, w/Mouse	010-1620-00
Keyboard	USB, US English	010-1621-00
Mouse	USB, Mouse, Optical	010-1622-00

Assembly Drawings and Schematics

The following assembly drawings and schematics are included as part of this manual.

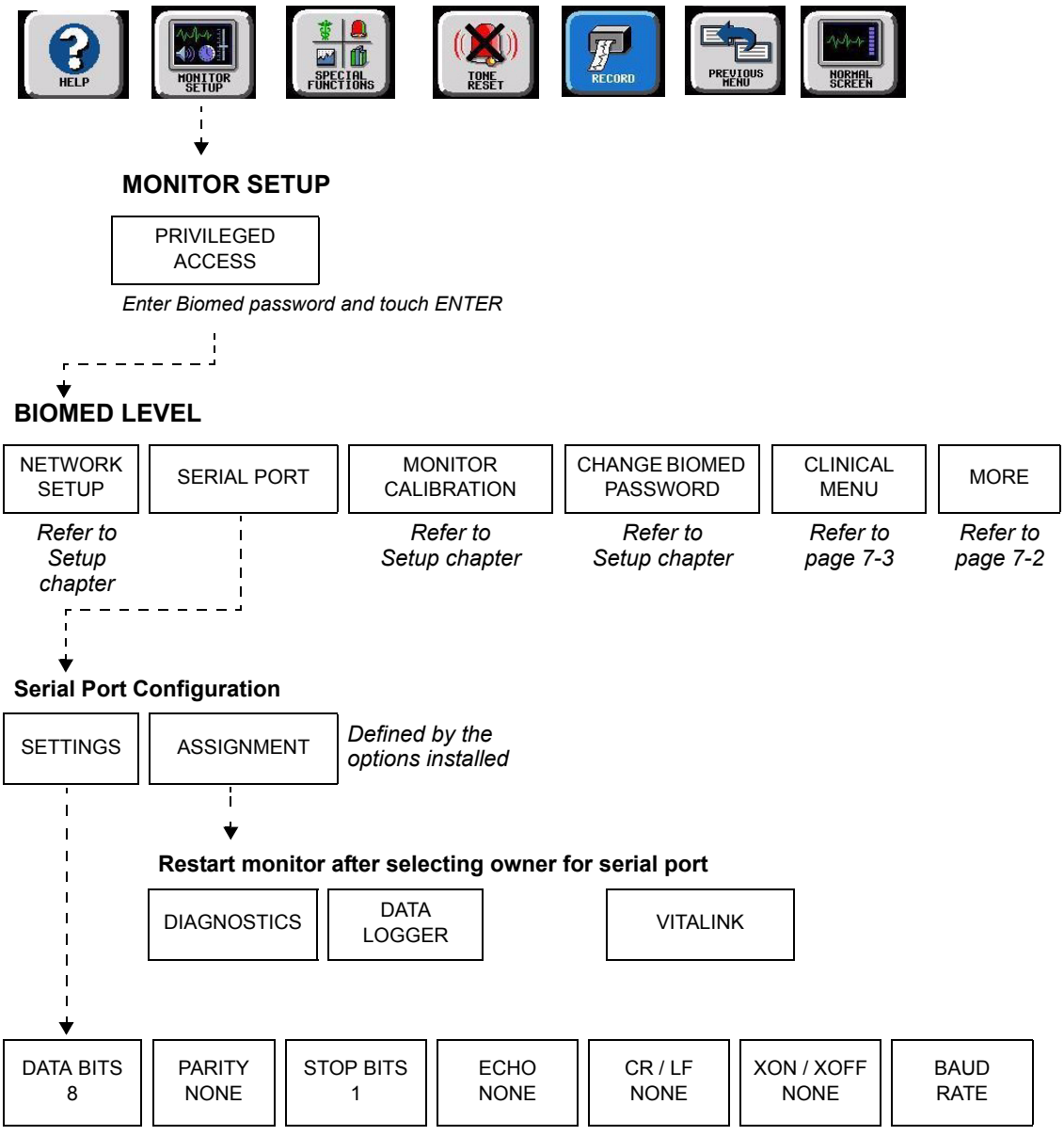
Table 5: Assembly Drawings and Schematics

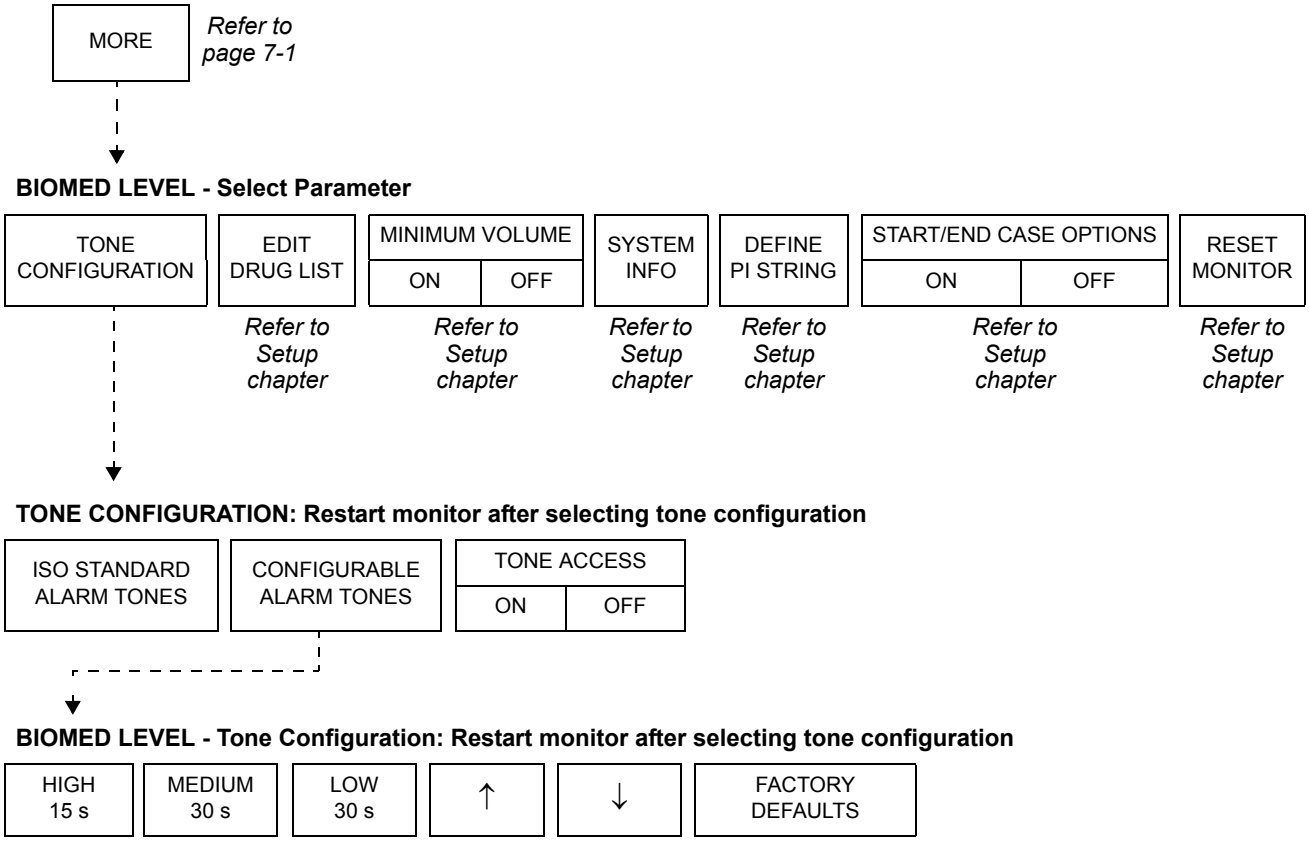
Title	Drawing Part Number	Drawing Number
Monitor Assembly	N/A	1 (9 sheets)
Schematics, PCBA, CPU	676-0684-05	2 (52 sheets)
Schematics, PCBA, I/O	676-0705-00	3 (3 sheets)
Schematics, PCBA, Interconnect	676-0148-02	4 (3 sheets)
Schematics, PCBA, CPU, Recorder	676-0012-00	5 (4 sheets)
System Block Diagram	N/A	6 (1 sheet)

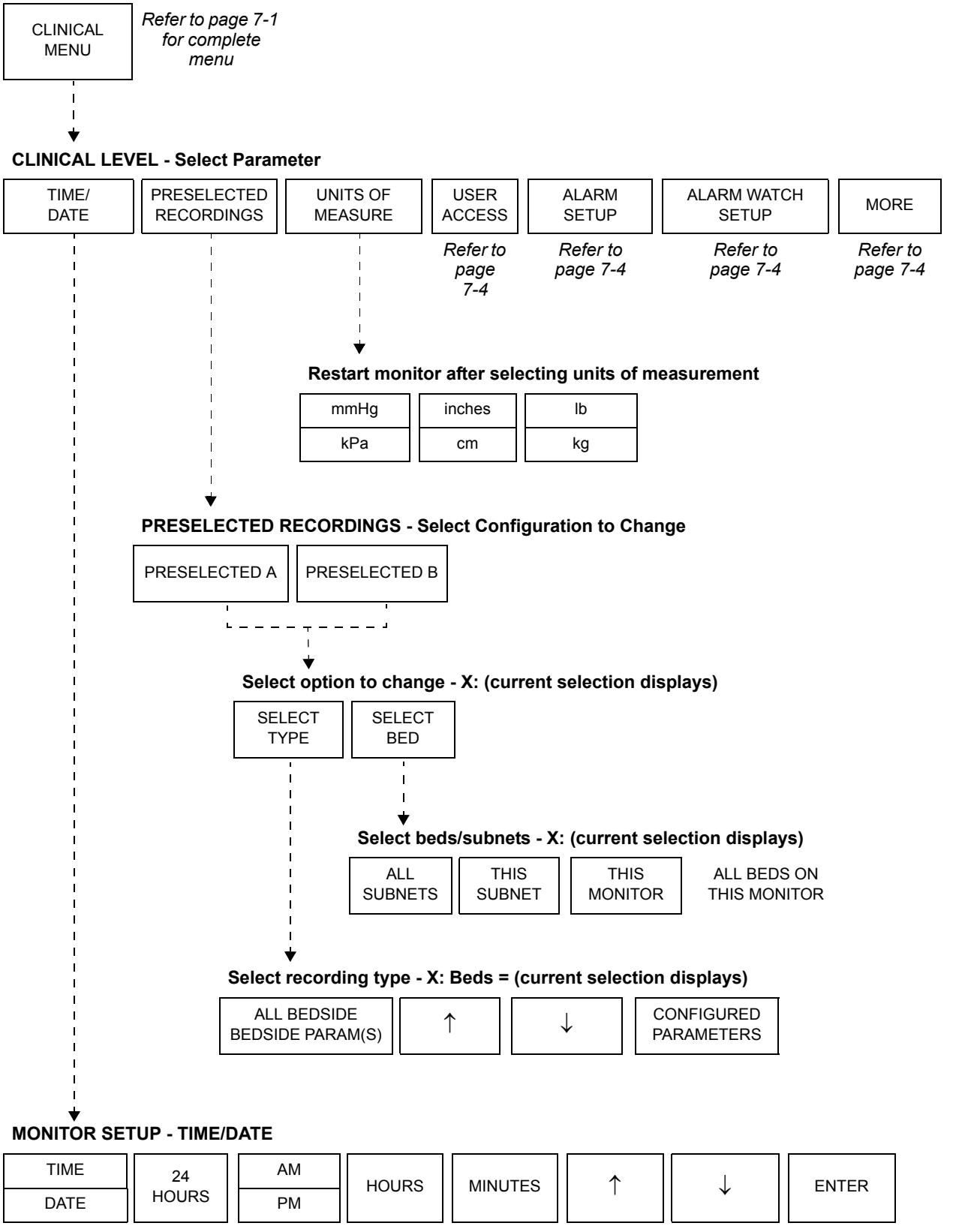
Directory of Keys

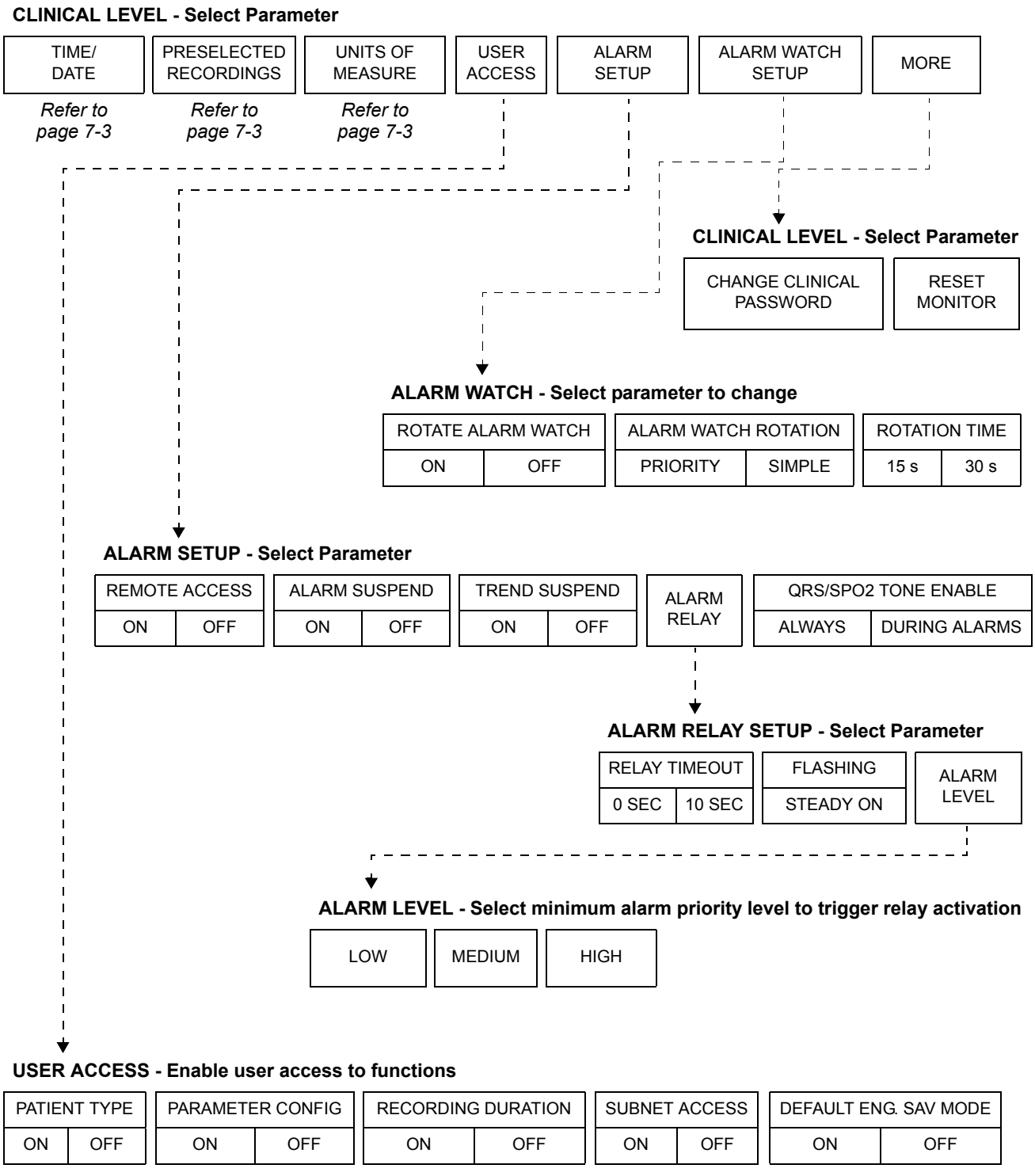
BIOMED Directory of Keys

The **Biomed Level** menu displays when the operator enters the Biomed password into the **Privileged Access** window. An alternative means of displaying this menu is to enter either the CSR or SL passwords and then select the BIOMED MENU key.




MORE
Refer to page 7-1
BIOMED LEVEL - Select Parameter
TONE CONFIGURATION
EDIT DRUG LIST
MINIMUM VOLUME
ON
OFF
SYSTEM INFO
DEFINE PI STRING
START/END CASE OPTIONS
ON
OFF
RESET MONITOR
Refer to Setup chapter
Refer to Setup chapter
Refer to Setup chapter
Refer to Setup chapter
Refer to Setup chapter
Refer to Setup chapter
TONE CONFIGURATION: Restart monitor after selecting tone configuration
ISO STANDARD ALARM TONES
CONFIGURABLE ALARM TONES
TONE ACCESS
ON
OFF
BIOMED LEVEL - Tone Configuration: Restart monitor after selecting tone configuration
HIGH 15 s
MEDIUM 30 s
LOW 30 s
↑
↓
FACTORY DEFAULTS


CLINICAL MENU
Refer to page 7-1 for complete menu
CLINICAL LEVEL - Select Parameter
TIME/ DATE
PRESELECTED RECORDINGS
UNITS OF MEASURE
USER ACCESS
ALARM SETUP
ALARM WATCH SETUP
MORE
Refer to page 7-4
Refer to page 7-4
Refer to page 7-4
Refer to page 7-4
Restart monitor after selecting units of measurement
mmHg
kPa
inches
cm
lb
kg
PRESELECTED RECORDINGS - Select Configuration to Change
PRESELECTED A
PRESELECTED B
Select option to change - X: (current selection displays)
SELECT TYPE
SELECT BED
Select beds/subnets - X: (current selection displays)
ALL SUBNETS
THIS SUBNET
THIS MONITOR
ALL BEDS ON THIS MONITOR
Select recording type - X: Beds = (current selection displays)
ALL BEDSIDE BEDSIDE PARAM(S)
↑
↓
CONFIGURED PARAMETERS
MONITOR SETUP - TIME/DATE
TIME
DATE
24 HOURS
AM
PM
HOURS
MINUTES
↑
↓
ENTER


CLINICAL LEVEL - Select Parameter
TIME/ DATE
PRESELECTED RECORDINGS
UNITS OF MEASURE
USER ACCESS
ALARM SETUP
ALARM WATCH SETUP
MORE
Refer to page 7-3
Refer to page 7-3
Refer to page 7-3
CLINICAL LEVEL - Select Parameter
CHANGE CLINICAL PASSWORD
RESET MONITOR
ALARM WATCH - Select parameter to change
ROTATE ALARM WATCH
ON
OFF
ALARM WATCH ROTATION
PRIORITY
SIMPLE
ROTATION TIME
15 s
30 s
ALARM SETUP - Select Parameter
REMOTE ACCESS
ON
OFF
ALARM SUSPEND
ON
OFF
TREND SUSPEND
ON
OFF
ALARM RELAY
QRS/SPO2 TONE ENABLE
ALWAYS
DURING ALARMS
ALARM RELAY SETUP - Select Parameter
RELAY TIMEOUT
0 SEC
10 SEC
FLASHING
STEADY ON
ALARM LEVEL
ALARM LEVEL - Select minimum alarm priority level to trigger relay activation
LOW
MEDIUM
HIGH
USER ACCESS - Enable user access to functions
PATIENT TYPE
ON
OFF
PARAMETER CONFIG
ON
OFF
RECORDING DURATION
ON
OFF
SUBNET ACCESS
ON
OFF
DEFAULT ENG. SAV MODE
ON
OFF

Glossary

The following terms appear in this manual:

ADC

Analog to digital converter

AP

Access Point

ASCII

American Standard Code for Information Interchange. A standardized way of assigning numerical codes to characters and control codes.

ATE

Automated test equipment used in performance testing of printed circuit assemblies.

Baud rate

Data transfer rate associated with serial data transfers, typically between personal computers via modems. Example: 9600 bits per second.

Bit map

Technique of drawing computer images by mapping the image in RAM.

BNC

A push and twist connector that allows a fast connect/disconnect of thin coaxial cable.

Boot ROM

Programmed ROM devices that contain basic data required to start a digital system at power up. This data generates instructions to the processor, allowing a limited set of start-up instructions.

CFI

Common Flash Interface

Checksum

A count of the number of bits in a transmission unit, which is included with the transmission unit, so that a receiver can check to see whether the same number of bits arrived.

CMOS RAM

Battery backed up device used to store configuration information such as node name, node ID, or bed names.

CODEC

An integrated circuit that performs communications data conversion

Composite video

Video display signal containing both video and sync information.

Compact Flash card adapter

A memory card that uses flash memory to store data

CPU

Central Processing Unit

CR/LF

Carriage Return / Line Feed

CTS

Clear To Send signal used in communication protocols.

DB9

“D” shaped, 9-pin connector of either male or female gender.

DB15

“D” shaped, 15-pin connector of either male or female gender.

DB15HD

High-density, “D” shaped, 15-pin connector with DB9 shell and footprint.

DB26

“D” shaped, 26-pin connector of either male or female gender.

DECNET

A proprietary network protocol.

Degauss

Process of removing a magnetic charge from a material. Color CRT screens are most susceptible to this type of charge creating “purity” problems.

DHCP

Dynamic Host Configuration Protocol, a networking protocol.

DIN

A standard for cable connectors.

DNS

Domain Name System. Translates domain names into IP addresses.

Dot pitch

Method of comparison used to determine the quality of a display. It indicates the angle and proximity each dot has to the other.

DRAM

Dynamic Random Access Memory used for computer memory systems.

DSUB

A type of cable connector.

DTR

Data Terminal Ready signal used in communications protocol.

Glossary

EEPROM

Electrically Erasable Programmable Read Only Memory. The portion of the monitor's memory which holds sysgen information and hardware configurations.

EMI

Electromagnetic Interference generated by repetitive signals such as microprocessor clocks that can interfere with other devices or two-way radio communications.

EPP

Enhanced Parallel Port

ESD

Electrostatic Discharge. High voltage potentials carried on the body that are generated by walking across a carpeted floor or caused by low humidity environments, which can be discharged into an electronic device, damaging it.

Ethernet

The LAN technology that uses CSMA/CD physical access method and 10/100 Mbps digital transmission. The forerunner of the IEEE802.3 CSMA/CD standard.

Flash ROM

A type of EEPROM that can be erased and reprogrammed in blocks instead of one byte at a time.

Ferrite

RF (radio frequency) glossy material used in EMI suppression.

FPGA

Field-Programmable Gate Array.

Flexport System Interface

Spacelabs Medical device that communicates via RS232 with other manufacturer's equipment.

FRU

Field-replaceable unit

FTP

File Transfer Protocol. The protocol for exchanging files over the Internet.

GDS

Global Data System

GPCM

General purpose chip select machine, used as an interface between the processor and memory

GPIO

General Purpose Input Output

High level output

Analog signals supplied through a separate connector for use with external equipment.

HRESET

Hardware reset

IC

Integrated circuit

I/O

Input/Output port or device

IEEE

A U.S. professional organization active in the creation, promotion, and support of communications specifications and standards.

IP Address

Internet Protocol Addresses used in TCP/IP. Identifies packet origin/ destination.

IRTS

Infrared Touchscreen. One of the user interfaces to the Spacelabs Medical monitoring system.

ISA

Industry Standard Architecture. A standard bus (computer interconnection) architecture

JTAG port

A test access port used for testing printed circuit boards

Kernel

The center of a computer operating system, which provides basic services for all other parts of the operating system

LAN

Local Area Network. A network system that provides a relatively small area with high speed data transmission at a low error rate.

LCD

Liquid crystal display

LED

Light emitting diode

Light transmittance

Measure of light levels as measured at the face of the CRT.

Lithium

Material used to construct a high energy battery for use in CMOS backed circuits.

MAC address

Media Access Control address. A unique identifier attached to networking equipment.

Mbit

Measurement used for RAM devices. Example: a 4 Mbit device will contain 4 megabits of data.

MDC

Management Data Clock

MDIO

Management Data Input/Output

MII

Media Independent Interface

Monitor Name

Unique name entered into the monitor, identifying it to all other monitors on the network.

Monitor ID

Unique identification entered into the monitor, allowing an Ethernet address to be assigned.

NiMH

Nickel metal hydride battery; a type of rechargeable battery

Node

A device that is connected as part of a computer network

NTSC

National Television Standard used for U.S. television video formats.

NVRAM

Non-Volatile RAM

OEM

Original equipment manufacturer

OTPROM

One Time Programmable Read Only Memory device

PAL

International television video format

Packets

The units of information used in computer networks that use packet switching

PCB or PCBA

Printed Circuit Board or PCB Assembly

PC Card

A card designed to be inserted into devices to enable extra functions

PCI

Peripheral Component Interconnect

PCMCIA

Personal Computer Memory Card International Association. Refers to the type of type I card that adds ROM or RAM and can be exchanged without rebooting the system.

PFAIL

Power Failure notification line used to notify the CPU of an imminent AC power failure.

PIXEL

Smallest unit displayed on a CRT. One PIXEL equals a single dot on the display.

PHY

Physical layer

PI

Patient Identifier

Plenum rated

Cable that must be used where toxic gases created by heat during a fire could not be tolerated. The plenum term refers to the return air path for an air conditioning system.

PM

Preventive Maintenance

PMC

PCI Mezzanine Card

Primary printer

Network printer that has first priority in receiving print requests.

Printer Name

Name placed into the monitor to allow the user to send hard copy recordings to a specific network printer.

Privileged access

Monitor operations not accessible to all users. A password is required to access these functions.

PS/2

IBM standard

PVC

Poly Vinyl Chloride used in production of non-plenum cables.

RAMDAC

Digital-to-Analog Converter with memory that converts digital video to analog video.

RGB

Red, Green, Blue

RISC

Reduced Instruction Set Computing

ROM

Read Only Memory

RTC

Real Time Clock

RTGL

Real Time Graphics Library

RTS

Ready-To-send signal used in communications protocols.

RXD

Receive Data. Used in communications protocols.

SDLC

Synchronous Data Link Control. Used for communication between the monitor and external devices such as modules, telemetry housings or Flexport interfaces.

Secondary printer

Network printer where printing requests made at a bedside or central are sent to if a primary printer is busy.

SIMM

Single In-line Memory Module

SMA

Shared Memory ASIC

SRAM

Static RAM (CMOS RAM)

SSID

Service Set Identifier. A sequence of characters attached to all packets on a wireless network to identify each packet as part of that network.

Stop bits

Quantity of bits used to discontinue transfer block in serial communications.

Subnet Mask

Part of an IP address that is allocated for a subnetwork.

Subnet Name

Unique subnetwork name identifying logically separated networks.

SuperCap

A type of capacitor

Sysgen

Spacelabs Medical's method to enable purchased options.

Tap block plug

Dummy plug used to seal up an unused hole tapped into a coaxial cable on an Ethernet system.

Tap block

Device used to "tap" into an active or inactive Ethernet coax cable.

TCP/IP

Transmission Control Protocol/ Internet Protocol used as an underlying mechanism for moving packets of information between different machines on a local or wide-area network.

TFT

Thin-film transistor; a technology used in liquid crystal displays

TLB

Translation Lookaside Buffer

Terminator

A resistive load attached to each end of a coaxial cable segment, or at a single end of an SDLC line. The function of a terminator is to match the characteristic impedance of the cable.

Transceiver (Ethernet)

Device located on coax cable or line powered attaching monitors to the network. These devices are bi-directional.

TTL

Time to live. The allowed number of hops the IP packet can take across network devices.

TXD (Transmit Data)

Transmit Data. Used in communications protocols.

UART

Universal Asynchronous Receiver/Transmitter; a microchip that controls the computer's interface to its attached serial devices

UPS

Uninterruptible Power Supply. Used to hold power up until AC mains are restored.

USB

Universal Serial Bus

UUT

Unit Under Test

VBA

Video Bus Array

VBB

Lithium Voltage Battery Backup

VPP

Voltage used for programming devices

VRAM

Video RAM

WEP

Wired Equivalent Privacy. A security protocol used to secure wireless networks.

WLAN

Wireless Local Area Network.

WDT

Watch Dog Timer

XON/XOFF

Used in communication definitions

Appendix A — Electromagnetic Compatibility

Contents

Electromagnetic Emissions

Emission Test	Compliance	Electromagnetic Environment
RF emissions **CISPR 11**	Group 1 Class B	The monitor uses RF energy only for internal function. Therefore, RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
Harmonic emissions **IEC 61000-3-2**	Complies	Device Class A
Voltage fluctuations/ flicker **IEC 61000-3-3**	Complies	

Electromagnetic Immunity

Note:

The monitor is intended for use in the electromagnetic environment specified below. The customer, or user, of the monitor should ensure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	8 kV contact 15 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output data lines	±2 kV for power supply lines ±1 kV for input/output data lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	1 kV differential mode 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	<5% U_T (>95% dip in U_T for 0.5 cycle) 40% U_T (60% dip in U_T for 5 cycles) 70% U_T (30% dip in U_T for 25 cycles) <5% U_T (>95% dip in U_T for 5 seconds)	<5% U_T (>95% dip in U_T for 0.5 cycle) 40% U_T (60% dip in U_T for 5 cycles) 70% U_T (30% dip in U_T for 25 cycles) <5% U_T (>95% dip in U_T for 5 seconds)	Mains power quality should be that of a typical commercial or hospital environment. The monitor automatically switches to internal battery operation during mains power interruptions.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	60 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note: U_T is the AC mains voltage prior to application of the test level. All power line immunity tests were performed at 120 VAC/60 Hz and 230 VAC/50 Hz.			

Separation Distances

Note:

The monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer, or user, of the monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the monitor, as recommended below, according to the maximum output power of the communications equipment.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Monitor (Always evaluate electronic equipment on site before use)

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 Vm 80 MHz to 2.5 GHz	20 V r.m.s 1 kHz sine 80% AM 20 V/m 1 kHz sine 80% AM	Portable and mobile RF communications equipment should be used no closer to any part of the monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance:** $d = \left[\frac{3.5}{V_1}\right]\sqrt{P}$ 150 kHz to 80 MHz $d = \left[\frac{3.5}{E_1}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{7}{E_1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,* should be less than the compliance level in each frequency range.**  Interference may occur in the vicinity of equipment marked with the following symbol. IEC 60417-5140: Non-ionizing electromagnetic radiation.

* *Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the monitors are used exceeds the applicable RF compliance level above, the monitors should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the monitors.*

** *Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [V_1] V/m.*

Rated maximum output power of transmitter (watts)	Separation distance according to frequency of transmitter (meters)		
	150 kHz to 80 MHz	80 MHz to 800 MHz	800 MHz to 2.5 GHz
0.01	0.02	0.02	0.04
0.1	0.06	0.06	0.1
1	0.2	0.2	0.4
10	0.6	0.6	1.1
100	1.8	1.8	3.5
Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. **Note 2:** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.			

Appendix B — Symbols

The following list of international and safety symbols describes all symbols used on Spacelabs Medical products. No one product contains every symbol.

HELP Key

SPECIAL FUNCTIONS Key

RECORD Key

NORMAL SCREEN Key

MONITOR SETUP Key

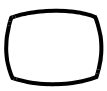
ALARMS Key

PREVIOUS MENU Key

ON — Power Connection to Mains

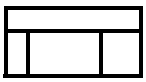
ON Position for Push Button Power Switch

On Direction



Television; Video Display

ON — Part of the Instrument Only



Keyboard Connection

Mouse Connection

START/STOP Key

START/STOP

STOP or CANCEL Key

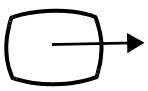
CONTINUE Key

ENTER Key

OFF — Power Disconnection from Mains

OFF Position for Push Button Power Switch

ON/OFF



Video Output

OFF — Part of the Instrument Only

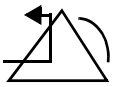
Appendix B — Symbols


Standby


STANDBY Key
Power ON/OFF Key

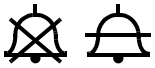

PAUSE or INTERRUPT


Slow Run


Alarm Reset

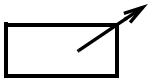

Power Indicator LED

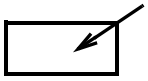

Alarm Audio ON


Alarm Audio OFF


Alarm Audio Paused


Activate Telemetry Recorder


Indicator — Remote Control


Indicator — Local Control


PRINT REPORT Key


Indicator — Out of Paper


Partial ON/OFF


Recorder Paper


Normal Screen


Return to Prior Menu


Clock/Time Setting Key


TREND/TIMER Key


HELP (Explain Prior Screen) Key

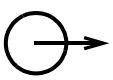

Keypad

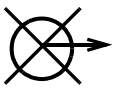

Activate Recorder for Graphics

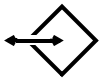

Indoor Use Only

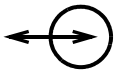

START (NIBP) Key


Auto Mode (NIBP)


Output (Non-terminated)


No Output (Terminated)

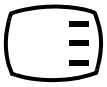

Data Input/Output


Input/Output


Input


Reset


Menu Keys

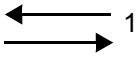

Waveform/Parameter Keys


Monitor Setup
Select Program Options

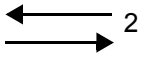
Set Initial Conditions Menu

Access Special Function Menu


Return Unit to Monitor Mode

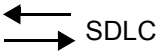


Serial Port 1



Serial Port 2


External Marker Push Button
Connection



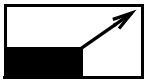
SDLC Port


Arterial Pulse

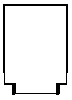

Electrocardiograph or
Defibrillator Synchronization


Gas Exhaust


Foot Switch


Enlarge, Zoom

Delete


PCMCIA Card

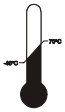

Event


Keep Dry

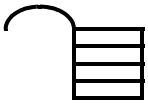

Fragile; Handle with Care

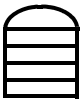
Environmental Shipping/Storage
Altitude Limitations


This Way Up


Environmental Shipping/Storage
Temperature Limitations

Environmental Shipping/Storage
Humidity Limitations


Open Padlock


Closed Padlock

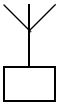

Down Arrow

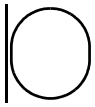

Up Arrow


Hard Drive

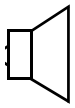

Power Indicator LED


Antenna

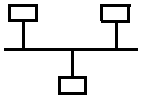

Mermaid Connector


Microphone

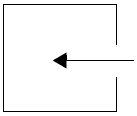

Omnidirectional Microphone

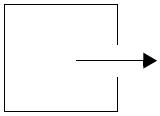

Audio Output, Speaker


Universal Serial Bus


Network Connection

Ref
Oxygen reference gas port


Gas Sampling Port


Gas Return Port


Low Priority Alarm

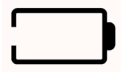

Nurse Call


High Priority Alarm


Medium Priority Alarm


Alarms Paused


Nurse Alert Interface

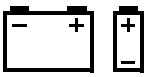

Battery Status


Alarm OFF

Battery
Replace only with the appropriate battery.


Low Battery

All batteries should be disposed of properly to protect the environment. Lithium batteries should be fully discharged before disposal. Batteries such as lead-acid (Pb) and nickel-cadmium (Ni-Cd) must be recycled. Please follow your internal procedures and or local (provincial) laws regarding disposal or recycling.



Replace only with the appropriate battery.
(+ / - signs may be reversed)

Caution - hazardous voltages. To reduce risk of electric shock, do not remove the cover or back. Refer servicing to a qualified field service engineer (U.S.A.).
DANGER - High Voltage (International)

This symbol indicates that the waste of electrical and electronic equipment *must not* be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

Protective Earth Ground

Functional Earth Ground

Replace Fuse Only as Marked

Fuse

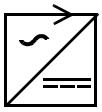
Power supply jack polarity.
(+ / - signs may be reversed)

Equipotentiality Terminal

Alternating Current

Direct Current

Both Direct and Alternating Current



AC/DC Input

A

Amperes

Hz

Hertz

V

Volts

W

Watts

IEC 60601-1 Type B equipment. The unit displaying this symbol contains an adequate degree of protection against electric shock.

IEC 60601-1 Class II equipment, double-isolated. The unit displaying this symbol does not require a grounded outlet.

IEC 60601-1 Type BF equipment which is defibrillator-proof. The unit displaying this symbol is an F-type isolated (floating) patient-applied part which contains an adequate degree of protection against electric shock, and is defibrillator-proof.

IEC 60601-1 Type BF equipment. The unit displaying this symbol is an F-type isolated (floating) patient-applied part providing an adequate degree of protection against electric shock.

IEC 60601-1 Type CF equipment. The unit displaying this symbol is an F-type isolated (floating) patient-applied part providing a high degree of protection against electric shock, and is defibrillator-proof.

IEC 60601-1 Type CF equipment. The unit displaying this symbol is an F-type isolated (floating) patient-applied part providing a high degree of protection against electric shock.

Loop Filter

Adult NIBP

ETL Laboratory Approved

Canadian Standards Association Approved

Risk of Explosion if Used in the Presence of Flammable Anesthetics

Operates on Non-Harmonized Radio Frequencies in Europe

Note

Note

Attention - Consult Operations or Service Manual for Description

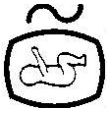
Warning

Warning About Potential Danger to Human Beings

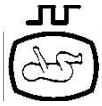
Caution

Caution About Potential Danger to a Device

Noninvasive Blood Pressure (NIBP), Neonate



Fetal Monitor Connection (Analog)

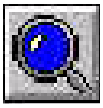


Fetal Monitor Connection RS-232 (Digital)

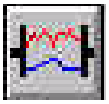
Physiological Monitor Connection RS-232 (Digital)

Happy Face

Sad Face



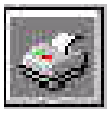
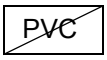
Magnifying Glass



Compression

File Cabinet

List of Rooms

	Arrows		Printer
	Recycle		Service Message
	Non Sterile		PVC-Free
	Latex-Free		Do Not Reuse; Single Use Only
	Radio transmitting device; elevated levels of non-ionizing radiation		Reusable
	Batch Code		Catalog Number
	Date of Manufacture		Nellcor Oxisensor II Compatible
	UL recognized component in Canada and United States		Novametrix Compatible
	Nellcor OxiMax Compatible		Spacelabs TruLink Compatible
	Masimo SET Compatible		Nellcor OxiMax Compatible
	Spacelabs Compatible		

Abbreviations used as symbols are shown below.

1 - 32	Access Codes 1 Through 32	**AIR**	Air
ANT 1	Diversity Antenna System 1	**Arr1**	Arrhythmia Net 1
ANT 2	Diversity Antenna System 2	**ArrNet2**	Arrhythmia Net 2

CH **ch**	EEG, EMG, or ECG Channel EEG Channels - CH1, CH2, CH3, CH4 EMG Channel - CH5	**cmH_2O**	Centimeters of Water
C.O. **CO** **co**	Cardiac Output	**DIA** **dia**	Diastolic
ECG **ecg**	Electrocardiogram	**EEG** **eeg**	Electroencephalogram
EMG **emg**	Electromyogram	**ESIS**	Electrosurgical Interference Suppression
EXT	External	**FECG**	Fetal Electrocardiogram
FHR1 **FHR2**	Fetal Heart Rate, Channel 1 Fetal Heart Rate, Channel 2	**GND** **gnd**	Ground
HLO **hlo**	High-Level Output	**Multiview**	Multi-Lead Electrocardiogram
NIBP **nibp**	Noninvasive Blood Pressure	**N_2O**	Nitrous Oxide
O_2	Oxygen	**PRESS** **press** **PRS**	Pressure
RESP **resp**	Respiration	**SDLC**	Synchronous Data Link Control
SPO2 **SpO2** **SpO_2** **SaO_2**	Arterial Oxygen Saturation as Measured by Pulse Oximetry	**SVO2** **$S\underline{v}O2$** **SvO_2**	Mixed Venous Oxygen Saturation
SYS **sys**	Systolic	**T1** **T2** **T3** **T4**	Temperature 1 Temperature 2 Temperature 3 Temperature 4
TEMP **temp**	Temperature	**UA**	Uterine Activity or Umbilical Artery

VAC	Vacuum Connection	**UV**	Umbilical Venous